THE SERVICE OF INFORMATION AND SECURITY

By W. S. PYE

LIEUTENANT COMMANDER UNITED STATES NAVY

1916

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W. S. PYE

LIEUTENANT COMMANDER, UNITED STATES NAVY

UNITED STATES NAVAL
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CHAPTER I.

INTELLIGENCE SERVICE IN PEACE AND WAR.

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If opposing armies could march unmolested to a designated battle field, as the knights of old repaired to their tournaments, the military problem would consist simply of drawing up the forces in order of battle, and nine-tenths of the difficulty of the art of war would be eliminated. But just as the code of ethics, which governs the action of individuals, is varied greatly when applied to the diplomacy of nations, so the chivalry and punctilio of private combat is necessarily lacking in the operations of war.[1]

It is the duty of every military commander to engage the enemy under circumstances favorable to himself and disadvantageous to his enemy; and under conditions of war, information of the enemy's dispositions and movements is a vital necessity to a commander on whom rests the responsibility of deciding the time and place and advisability of an engagement.

The greatest of military writers have all expressed themselves in the strongest terms on the necessity for such information:

Information is the foundation of all our ideas and actions.—CLAUSEWITZ.

How can any man decide what to do himself if he is ignorant of what his enemy is about?—JOMINI.

If one could always be acquainted beforehand with the enemy's designs, one would always beat him with an inferior force.—FREDERICK THE GREAT.

In nothing more than in war, knowledge is power.—FURSE.

A general who does not campaign in the desert but in a fairly populated country, and has no information, is ignorant of his calling.—NAPOLEON.

The information and the news which can be procured about the enemy, his armed force, his territory, his resources in wealth, and his moral character, are the base of all the plans and movements of his adversary.—CLAUSEWITZ.

Much of this necessary information can and should be obtained during peace, for a declaration of war or the outbreak of hostilities is immediately followed by a cessation of the flow of information through the usual peace channels. Our diplomatic representatives, with the accompanying naval and military attachés, must leave the enemy territory. Not only is military and naval information jealously guarded, but false information is spread broadcast. Rumors become common. No information can be considered accurate unless verified by trusted agents.

With regard to information in war Clausewitz says: "When one considers how unreliable this information must be, and how inconsistent and shifting are all rumors and how every possible means of

[1] Furse: "Information in war."

deception are used, we can easily understand how unstable is the military scaffolding and how easy it is for the whole structure to tumble to pieces, and all connected with it."

This uncertainty with regard to the enemy's forces and probable course of action constitutes one of the chief impediments in the formulation of a plan of campaign.

Indecision or delay, caused by waiting for information before acting, may first paralyze an army and then give it over to destruction.

The habit of estimating the situation, a system of logical reasoning, is essential to success under such conditions. The application of sound reasoning to the situation, as presented by such substantial information as is available, will most frequently lead to a sound conclusion with regard to the enemy's probable intentions.

Information ought to be the handmaid of intention. The quest for information must be directed by the will, and the value of information depends upon the influence that it exercises upon the free play of that will. In itself and by itself, information is nothing, least of all a substitute for intention.[1]

Information enables *intention* to make its dispositions according to the results that it means to achieve and the risks that it must be prepared to face.[1]

A plan of campaign having been decided upon after thorough deliberation should not be changed except upon well-substantiated evidence. Rumors must be investigated and their accuracy determined. Too much value must not be awarded them, yet they must not be entirely neglected. *Absence of information* is best personified as a little devil, who constantly whispers in one's ear, "You better change your plan." The relief from this impertinence is a belief in one's own ability.

To inspire confidence one must be confident; but this faith in one's own ability must not become stubbornness, for stubbornness might cause one to persist in a plan which later authentic information shows to be faulty. The ability to estimate the influence of the enemy's movements upon the outcome of a contemplated operation, is essential to the successful conduct of war. Failure to alter a plan upon *adequate information* is only one step better than changing it upon *insufficient information.*

The difficulty and delay encountered in the acquisition of information adds greatly to the chance of success of the force that can take the initiative, for the enemy, lacking information, can only tardily conform to its movements. A lack of information frequently causes confusion and hesitancy, which are precursors of defeat.

Information is the groundwork upon which plans are constructed. Accuracy is vital, but the most accurate information is of no value if not received in time. Accurate, timely information bestows the power of initiative, which, if properly used, may be the decisive

[1] Cordonnier: "Japanese in Manchuria," vol. 2.

factor in the campaign. Victory or defeat often rests upon the veracity and opportuneness of the information received. The greatest talent can be of little value to a commander who is provided only with false or greatly delayed information.

General Thiebault has said:

A warning received opportunely may secure victory and prevent defeat. War is only doubtful in its results because it is possible to fall into error with regard to the movements of one's adversary. He who can learn them without delay or uncertainty will not have to fear an unlucky chance. In ordinary wars it is impossible to acquire this knowledge thoroughly and promptly, and the most trifling information is often obtained only too late and with the greatest difficulty.

The advantage given to a force by early accurate information makes manifest the necessity of denying information to the enemy.

INFORMATION REQUIRED.

In order to decide upon the size and characteristics of ships required, and of the proper strategic disposition of the naval force of a nation in the event of war, the Navy Department must know with a fair degree of accuracy:

1. The policy of each government, the antagonism of which to our own policy may cause a war.
2. The military, naval, and financial resources of such governments.
3. The strength and disposition, state of preparation and efficiency of their naval forces.
4. The ideas of strategy and tactics prevalent in their naval services.
5. The national characteristics that may be exhibited during the war.
6. The characteristics of prominent naval officers and the probable assignments of such officers in war.
7. Data concerning the probable theaters of operation.
8. Probable intentions of each probable enemy.

The above classes of information may be termed *peace information*, for, while extremely useful in the period of preparation and also in war, the collection of such information should be accomplished during peace, as it is a much more simple operation during peace than during war.

Instances of failure to provide such information are far from rare, but such failure has been attended with greater disasters on land than on sea, though this will probably not be true of the future.

It has been stated that in formulating his plan for the attack of Lissa, neither Persano nor his chief of staff had the faintest idea of the strength of

the place which they were going to attack. They did not know what the works were like, whether the ships could assail them with any chance of success or what guns were mounted.[1]

With regard to the war in the Crimea, Hamley says:

It was as completely an unknown country to the chiefs of the allied armies as it had been to Jason and his argonauts when they journeyed thither in search of the Golden Fleece. It was known to contain a great harbor and a city with docks, fortifications, an arsenal, but the strength and resources of the enemy who would oppose us, the nature of the fortifications, and even the topography, except what the map could imperfectly show, lay much in the region of speculation.

The lessons of the past must be remembered and advantage taken of them. The charts for the conduct of a war against our two most probable enemies, such as would be required in war, are not now ready, and it would take many months to prepare them.

We have insufficient information concerning most of the harbors that come under discussion as to their suitability as temporary or permanent naval bases.

In addition to the above classes of information, with which all commanders in chief should be familiar, are the following, which deal more minutely with the operations of a particular campaign, and, therefore, must be ascertained after war is declared:

1. Information of enemy plans of operation.
2. Composition and disposition of forces immediately opposed.
3. Movements of such enemy forces.
4. Condition of such forces with regard to morale, fuel, and supplies.

INTELLIGENCE SERVICE.

Brackenbury states:

By the intelligence duties of the staff are to be understood: Firstly, the collection, sifting, and arrangement of all information required by Governments and military authorities to enable them to take such measures in peace as will insure the rapid commencement and vigorous prosecution of any war whether at home or abroad. Secondly, the diffusion of necessary or useful information through the army and country during peace and war.

The information required for the successful and economical prosecution of war is obtained with comparatively little difficulty during peace, and should be ready in concentrated form when war breaks out.

Let it not be supposed that there is some occult means by which neglect in peace could be atoned for in war. If the required information be not ready, it can not suddenly be obtained.[1]

In our service the Office of Naval Intelligence acts for the "Intelligence section of the General Staff" in the collecting, sifting, and arranging of the information received, while a section of the General

[1] Furse: "Information in war."

Board and the War College do most of the diffusing of information by corrections and additions to the war portfolios and by the War College courses.

A rough outline of the information required concerning each probable enemy has been given. Needless to say, the similar information of our own country and forces must be available. The latter will probably not be required from the intelligence office, but the responsibility for collecting this information should be definitely placed. Such information should be carefully prepared and should form the basis of the plan of mobilization.

Before going further the means by which information may be obtained will be examined. They are as follows:

1. State Department.
2. Consular reports.
3. Intelligence office (as it now exists).
4. Attachés.
5. Intelligence reports of officers on regular duty.
6. Newspapers.
7. Commercial reports.
8. Secret service.
9. Spies.

STATE DEPARTMENT.

With regard to the State Department, Colonel Furse says:

> There must naturally be a connection between the military intelligence department and the foreign office. On the subject of general policy, the latter receives from its diplomatic agents abroad much information relating to military matters, which can not be but most useful to the former, while the officers of the intelligence department, being specialists, can always supply the foreign office with their views on the probable military effects which may result from passing events.

It usually occurs that the theater of war is definitely settled by the location of the area with regard to which the policies of the opposing governments conflict. A thorough knowledge of these policies is, therefore, a vital necessity to the proper consideration of the major operations of a war.

The history of our country, and in fact of the entire Anglo-Saxon race, shows only too vividly the great lack of appreciation of the unseverable connection between policy and war.

CONSULAR REPORTS.

The consular reports contain much data concerning the quantity and size of shipping entering foreign ports, many of which ports are small and unimportant except in the event of war.

With proper questions to be answered by each consular officer, much data concerning anchorage, dockage, coaling, and repair facilities, etc., might be obtained for practically all ports of the world.

NAVAL ATTACHES.

The naval attachés, "who now form part of the staff of diplomatic agencies abroad, have to watch and report on all army (naval) matters in foreign armies (navies) in peace and in war, and through their services can afford information of no mean importance. Their duty, however, is of a delicate nature and requires considerable tact, for, being official agents of information, they are closely watched. Their task becomes more difficult as soon as there is some want of cordiality between the Government that sent them and the one to which they are accredited,"[1]

The closeness with which attachés are watched to prevent them from ascertaining information of matériel would seem to indicate that their time can be most profitably employed in obtaining information of the personal characteristics of the leading military and naval officers; the ideas of strategy and tactics prevalent in the military and naval forces; the general feeling of the public with regard to our policies; the probable places of mobilization and the time required to complete such mobilization; and the military, naval, and financial resources of the country.

A striking example of the results of not using information is that offered by the French Government in 1870. The excellent reports of the French military attaché in Berlin on the state of readiness and preparation of the German Army, were found after the war in the archives of Paris unopened.

INTELLIGENCE REPORTS.

Much information is obtained from intelligence reports of individual officers concerning ports visited, and officers should be encouraged to make intelligence reports, as such duty greatly benefits the individual as well as corrects or affirms information previously received.

NEWSPAPERS AND PERIODICALS.

Newspapers and periodicals furnish much of the information that is accumulated by our Office of Naval Intelligence during peace, and it is quite probable that the daily papers will be of great value in war.

Naturally, the papers that will be of the greatest benefit to us will be the large papers published in neutral countries. Our own papers and those of the enemy will probably be more or less censored, and may even publish false information to mislead the enemy.

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[1] Furse: "Information in war."

It is said that during the Franco-Prussian War, when McMahon attempted his disastrous march to the relief of Bazaine, the first news of this important movement came to Von Moltke through the French and English newspapers.

With the increasing efficiency of the means of gathering and transmitting news and with the constantly growing popular demand for late and complete information, it is probable that information conveyed by this means may be even more valuable in the future than in the past.

COMMERCIAL REPORTS.

The commercial world is always well supplied with information, especially with regard to movements and sales of ships, large quantities of coal, and other stores. Knowledge of the ships an enemy has bought or chartered; the times and places of delivery of large supplies of coal or provisions; the ships chartered for transports; all of these items and probably many more might be furnished by commercial reports. At any rate, our commercial houses, ship-brokerage firms, etc., should be encouraged to communicate with the Intelligence Office.

SECRET AGENTS AND SPIES.

Two more methods of acquiring information, other than by the use of military force, are available—secret service and spies. It is hard to differentiate between these classes, but for purposes of discussion they will be divided as follows:

Secret agents are those who report secretly to the intelligence office or its representatives, from positions on neutral territory or from neutral ships upon the high seas.

Spies, those who report secretly to the intelligence office or its representatives, from positions within the enemy jurisdiction.

Secret agents.—The service of secret agents in neutral ports and on neutral ships upon the high seas is an extension of the spy system to the conditions of naval war. On land a spy may frequent an enemy's camp and by stealth pass its outposts and report. This means is less available at sea; and, therefore, to obtain information of the movements of the enemy fleet, we must have agents at all ports at or near which the enemy ships may stop, as well as upon neutral vessels traveling the routes that the enemy fleet may use.

There may be many views as to whom these agents should report and to whom they should look for the payment for their services. It would appear that, in view of the great number of such agents required, it would be advisable to have this secret service divided into districts, the chief of each district to be the head of a large commercial house, if possible, in order that messages in commercial

form may be received and sent without suspicion. True, this would have many disadvantages, but it would likewise have the great advantage that the district chief would be familiar with local conditions and the character of the men whom he would employ. Being present at all times he could verify and substantiate any information received. His reports would be couched in commercial language and he would not be so closely watched as any direct representative.

Spies.—Colonel Furse says:

In war spies are indispensable auxiliaries, and when we are precluded from obtaining information by any other means, we must discard all questions of morality. We must overcome our feelings of repugnance for such an unchivalrous measure, because it is imposed upon us by sheer necessity. Necessity knows no laws, and means which we would disdain to use in ordinary life must be employed in the field, simply because we have no other that we can turn to profitable account. Information has been sought through spies in all wars, and we can plead in our favor that the enemy will not scruple to employ them in his behalf.

Spies may be primarily divided into two classes; military and civilian. The first class consists of officers or enlisted men, who, from patriotism or a sense of military duty, assume a disguise and penetrate the enemy's lines to gain information.

It has been pointed out that the difficulties of transmittal of information make it extremely doubtful whether an officer or man accompanying an enemy fleet could be of value. It seems possible that as part of the crew of an auxiliary such service might be valuable.

The second class consists of men who often deserve all the obloquy so freely cast upon spies in general, though instances are not lacking of civilian spies actuated solely by motives of disinterested patriotism. But whatever may be their motives or individual characteristics, spies are indispensably necessary to a commander, and, other things being equal, he will be victorious who has the best secret service and spies.[1]

In the following general remarks the word "spy" will be used to include both classes of secret agents which have been previously called secret agents and spies.

"Spies should be carefully selected from people whose occupations are such as to permit them to proceed about their work without creating suspicion."[1] It will be difficult to get men with sufficient knowledge of naval affairs to make their information valuable.

Men banished from their country, smarting under a sense of injustice, exasperated by ill-treatment, embittered by jealousy, or influenced, in short, by any strong passion calculated to incite a spirit of hatred and revenge against an enemy, are almost certain to be faithful and efficient spies.[1]

Spies should be tested, if practicable, with unimportant missions before being intrusted with matters of great moment. It is a good plan to require them at first to report on matters that are already known as a means of testing their reliability and accuracy.

[1] Furse: "Information in war."

A spy should never be allowed to see that he is mistrusted, but should be led to believe that particular confidence is reposed in him and that his services are regarded as highly valuable. At the same time other spies should be employed to cover the same ground, and their reports should be carefully compared.

A spy must always be well paid. He is usually working for money, and for money alone. A badly paid spy will generally strike a bargain, sooner or later, with the enemy.[1]

Spies should usually remain in a certain locality and send information by the usual channels to officers or trusted agents in a neutral country.

These communications, either telegraphic or by letter, may often be couched in commercial language and sent to persons in a neutral country by whom they are transmitted to the officials for whom they are intended.

The management of the secret service requires a profound insight into human nature, and an ability to estimate at once the military worth of the information received.

STRATEGIC DEPLOYMENT OF THE FLEET.

From the *peace information* obtained by the Office of Naval Intelligence, the diplomatic situation as obtained from the Department of State, and the information obtained of their own forces, the plan-making section of a General Staff decides upon the proper strategic deployment of the fleet in the event of war with any probable enemy.

This deployment, decided upon by *peace information*, may or may not extend beyond the mobilization period. Further operations by the fleet should be directed by the Commander in Chief under instructions from the Chief of Naval Operations.

The information which led to the issue of these instructions should be made available to the Commander in Chief, as all such information would, without doubt, affect his plans.

Information other than that termed "peace information" must be transmitted to the Commander in Chief, though much of it will pass through the Office of Naval Intelligence.

To realize the importance to the commander in chief of an efficient secret service and spy system it will only be necessary to consider the information that will be required by the commander in chief in order to decide upon the proper strategical operations to be undertaken by the fleet.

First, he would desire to know the size of the enemy force being mobilized, the places of mobilization, and the probable date of completion of mobilization of the active fleet and of the reserve.

Second, the time of departure from its home ports, or neutral ports, of any enemy force.

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[1] Furse: "Information in war."

Third, the probable destination and intention of the enemy.

While the first of these items may be approximated from peace information, such approximation should be checked by spies if possible. The nature of the force mobilizing, the number of auxiliaries, transports, destroyers, tugs, etc., may, and probably would, be of immense importance in estimating the enemy's probable intentions.

In the Atlantic the value of secret agents in neutral ports will be greater than in the Pacific, while the value of spies in the respective areas will be reversed.

The reason for this is that in the Atlantic our enemy will probably assume the strategical offensive, while in the Pacific our fleet will be forced to assume the strategical offensive.

In a campaign in the Atlantic it is practically a certainty that our enemy will stop in some of the islands of the eastern Atlantic. If our secret service in those islands is well organized, information of inestimable value may be received concerning our enemy's force, morale, supply, and time of departure.

If this information is accurate, it will greatly facilitate and aid the operation of our scouting forces. If the enemy's force is accurately known, his speed and steaming radius may be closely estimated. If the number of colliers and troop ships are known, his probable intentions can be more accurately estimated.

With our small scouting force this information will be invaluable, for the more closely we can estimate the enemy's speed and destination the more efficient will our small force be; the small area to be searched will permit of more concentration of, and less fuel consumption by our scouting force.

During the passage of an enemy fleet from a European port or from the eastern islands of the Atlantic, it is quite probable that it will be sighted by liners or by tramp steamers. We should have agents on all ships fitted with radio, whose routes cross this area. We should also have agents in the principal ports of call, whose duty it would be to ascertain from all shipping arriving in port what ships of the enemy had been encountered.

In both oceans the diplomatic attitude of the United States gives to our probable enemies the initiative, and, from past performances, we may judge that any of them will act with dispatch.

The promptness of action of our probable adversaries in their last wars should be an ever-present reminder that we must be prepared, and such preparation can only be complete when our secret service and spy system have been organized in time of peace. It will no doubt be greatly augmented in time of war, but the system must be perfected during peace.

With regard to the establishment of this service, Colonel Furse says:

A thorough organization of the intelligence service is anything but superfluous; if nothing more, the immense consequences of being always cognizant of the enemy's doings clearly proves how very necessary it is. Let us disabuse our minds that a service of this description can be improvised in the field. Nothing of the sort; for it requires such nicety of arrangements, such prevision, such knowledge of the general circumstances of war and of human nature, that a sound basis must be distinctly laid down in peace, and able men trained to undertake it. As nothing of what can be foreseen should ever be left to chance, the arrangements for procuring information in the field must form a recognized part of the preparation for war.

CHAPTER II.

HISTORICAL INSTANCES OF SCOUTING.

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HISTORICAL INSTANCES OF SCOUTING.

The past affords many illustrations of the value of accurate information as well as of the trials, disappointments, and failures that have been caused by the lack of it. False information, too, has played its part.

In the days during which most naval history was made, no means of transmission of information other than by direct communication or by signals was available, so we can hardly compare present methods with those of the past. A few examples to show the effect of accurate information or a lack of it, may not be wasted if they bring home the great influence of these factors in the naval history of the world.

One of the earliest instances of the use of ships for search operations or reconnoitering, as the actual operation might more correctly be called, was during the operations preceding the battle of Lepanto in 1571.

Before the concentration of the fleet of the allied Christian nations was complete, the commander in chief, Don Juan of Austria, dispatched a Spanish squadron of small fast ships, under command of Capt. Gil de Andrada, to reconnoiter the Adriatic for the purpose of locating and reporting the position of the Turkish fleet.

The task was successfully accomplished, and within a few weeks the Turkish Navy was destroyed.

In this case, the accurate information received probably only hurried the destruction of the Turks, for both fleets were confident of success. Better ships and better men won the day.

As the events at sea during the Nelsonic period played such a prominent part in history, it is but natural that we should turn to them for illustrations.

In view of the chronological order of the events to be cited, the following will be the order of the examples: Lack of information, false information, and accurate information.

The story of Nelson's chase of the French fleet from Toulon to Egypt is, in general, common knowledge to most naval officers, and

yet how few realize that only a few miles separated the English and French fleets while between Malta and Alexandria. Only the darkness of night prevented the discovery of the French fleet and an engagement, which, from the results at Aboukir, no one can doubt would have resulted in a British victory.

The life of Napoleon Bonaparte probably would have occupied a very small place in the history of the world had such action taken place, for Napoleon commanded the French fleet as well as the army which was being escorted to Egypt.

It will be remembered that at the time of the departure of the French fleet from Toulon, the British squadron received serious damage by a gale, in addition to which, Nelson was forced to proceed with only one of the frigates that had been assigned to his command, the others not having as yet joined his squadron. This ship, the *Mutine*, in command of Capt. Hardy, was sent on several missions to gain information, but each time returned without news.

In his report of the campaign, Nelson states:

> Here I had deeply to regret my want of frigates; and I desire it to be understood that if one-half of the frigates your Lordship had ordered under my command had been with me, I could not have wanted information of the French fleet.

The absence of these vessels and the corresponding lack of information undoubtedly saved to the French their greatest Emperor.

The story of the departure of the French fleet under Villeneuve from Toulon, and its escape to the West Indies, might also be cited as a victory lost through insufficient information. In this case, however, the failure to locate the French fleet was due to an incorrect estimate of the situation, influenced greatly by the former attack upon Egypt and also by the fact that Nelson's special station was the Mediterranean.

During the blockade, previous to Villeneuve's escape to the West Indies, Nelson kept several ships before Toulon at all times. Until dark on the day of Villeneuve's departure, two of the British frigates tracked the French fleet. One was then dispatched to warn Nelson. The other remained to keep touch, but during the night became separated and upon the following morning could not locate the enemy.

Upon the receipt of the information of Villeneuve's departure, "The commander in chief (Nelson) instantly dispatched such cruisers as he had with him to search for the French."

They failed to locate the French fleet, and it was long after that Nelson ascertained that it had passed out of the Mediterranean.

From the time the French were reported at sea until the decision was made to proceed to the West Indies, Nelson's sufferings from

this lack of information were exceedingly great. In his letters we find these statements:

> I believe this ill luck will go near to kill me; but as these are times for exertion, I must not be cast down, whatever I may feel.

In another:

> Broken hearted as I am at the escape of the French fleet from Toulon.

In spite of his worry and ill health he consistently examined all possible courses of the enemy fleet to the east or north, and then, by the process of elimination, decided that it had gone to the West Indies and followed it.

MacArthur says:

> When we consider the state of Lord Nelson's mind at that moment, his impaired health and spirits, the continual fatigue and anxiety which he had endured in being one whole month in getting down the Mediterranean, which the French had done in nine days, it is hardly possible to suppose that the human mind could embrace such a variety of subjects and yet keep steadily fixed on the great and leading one of all, the pursuit of so superior an enemy.

Nelson's correspondence shows his keen disappointment at the escape of the French upon each occasion, and should make us realize the terrific strain lack of information imposes upon a commander.

Writing during his pursuit of the French in 1798 he says: "Was I to die this moment, want of frigates would be found stamped upon my heart." Again, "No words of mine can express what I have and am suffering for want of frigates."

It was at the end of his remarkable voyage to the West Indies that the incident occurred which will be given as an example of false information.

> Soon after leaving Lagos Bay Nelson dispatched a fast sailing sloop, the *Martin*, to inform Lord Seaforth at Barbados of the approach of the French fleet and of his own pursuit. In this letter he begged that an embargo be laid on all vessels at Barbados, that the enemy might not be apprised of his arrival, and thereby again escape with his fleet.[1]

On the 4th of June he arrived at Barbados and there received the false information which led him directly away from the French fleet and permitted its escape from the Caribbean.

This unfortunate intelligence was conveyed to him while in Barbados in the following extract from a letter of Brig. Gen. Brereton, dated St. Lucia, May 29: "I have this moment received a report from the windward side of Gros Islet that the enemy's fleet of 28 sail in all passed there last night; their destination, I should suppose, must be either Barbados or Trinidad."

The governor of Barbados offered 2,000 troops, and, after these were embarked, Nelson stood to the southward to save Trinidad.

[1] MacArthur: "Life of Nelson."

The *Curieux*, brig, was detached to look into Tobago for information. Col. Shipley, of the engineers, was directed to communicate with the nearest post on Trinidad, in order to ascertain the situation of the enemy, and signals were agreed upon to convey the earliest information upon his return to the squadron.[1]

The British fleet stood to the southward with fine breezes and the next afternoon arrived off Tobago.

At Tobago all was bustle and apparent uncertainty when, in addition, the following singular occurrence took place:

A merchant particularly anxious to ascertain whether the fleet was that of a friend or enemy had prevailed on his clerk, with whom he had also agreed respecting signals, to embark in a schooner and to stand toward it, and it unfortunately happened that the very signal made by the clerk corresponded with the affirmative signal which had been agreed on by Col. Shipley—of the enemy being in Trinidad.[1]

Upon making out this signal shown by the schooner the British fleet bore away for Trinidad. A large part of the night was spent in preparing the fleet for battle. Visions of a second Aboukir were before all eyes.

What must have been the disappointment when, upon approaching Trinidad next morning, the harbor was found empty, and upon communicating with the shore information was received that no French vessels had been seen in that vicinity.

Twice the curse of false information had been placed on Nelson through no fault of his own. Referring to this in his report, he says:

But for that false information I should have been off Port Royal as they (the French fleet) were putting to sea and our battle most probably would have been fought on the spot where brave Rodney beat De Grasse.

The same cruise of the allied fleet furnishes an example of the value of accurate information when received in time.

Upon Nelson's departure from the West Indies he dispatched one of his brigs, the *Curieux*, to inform the admiralty of his operations in the West Indies and of his intended return to the Mediterranean. En route to England the *Curieux* sighted the allied fleet. With prompt decision the *Curieux* pressed on to England and informed the admiralty of the position of the allies and of Nelson's intentions. Lord Barham, first lord of the admiralty, immediately reinforced Admiral Calder and directed him to await the allies to the westward of Cape Finisterre.

Not many days after, the allies were discovered and engaged in battle, which, though indecisive, prevented Villeneuve from gaining the port of Ferrol, which was his desired destination. That the action was indecisive fails in no degree to show the advantage of the prompt action of the *Curieux* or the benefit derived from her accurate, timely information.

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[1] MacArthur: "Life of Nelson."

Villeneuve put into Vigo. Several days later, by a lucky shift of the wind, he was able to proceed unmolested to Ferrol. From Ferrol he escaped to Cadiz without being brought to action, and in this port Nelson found the allies upon his return to the fleet as commander in chief.

Nelson's dispositions before Cadiz were as follows:

Blackwood's squadron of frigates cruised day and night close to the harbor's mouth. An advanced squadron of fast sailing seventy-fours was thrown out 10 or 12 miles east of the fleet for signal duty. The main body was 50 miles to the westward of Cadiz.

On the 14th of October the allied fleet shifted to the outer harbor of Cadiz, and the following dispositions were made. Quoting Nelson's diary: "Enemy at harbor's mouth. Placed *Defense* and *Agamemnon* from 7 to 10 leagues west of Cadiz and *Mars* and *Colossus* 5 leagues east of fleet (that is underway between the fleet and former group), whose station is from 15 to 20 leagues west of Cadiz, and by this chain I hope to have constant communication with the frigates off Cadiz."

To the captain of the *Defense* he wrote that it was possible the enemy might try to drive off the frigate squadron in order to facilitate their own evasion, in which case the inner ships of the line would be at hand to resist the attempt.

Despite these careful dispositions his mind was still ill at ease lest the enemy might escape undetected. He never had frigates enough to make the result as sure as it ought to be where such vast issues were at stake. * * * This deficiency he urged upon the Government still more than he did the inadequacy of the line-of-battle force, for his fear of the enemy eluding him was greater than that of a conflict with superior numbers.[1]

He wrote Lord Barham, "The last fleet was lost to me for want of frigates."

The allies did not attack Nelson's lookouts before the fleet sailed, but upon the following morning they drove off the frigates, thus giving an example of the proper use of fast ships for the purpose of denying information. That the allied fleet was unsuccessful in its attempted evasion was due to Nelson's disposition of his heavier ships.

Our War with Spain is too recent for the uncertainties, doubts, and fears caused by our inability to find Cevera to have been forgotten. It need only be said that had the Spanish Navy been of more power and efficiency, the failure of our scouting operations might have been the deciding feature of the naval campaign in the Atlantic.

Only five scouts were used in our search operations for the Spanish fleet. Two of these scouts, the *Minneapolis* and *Columbia*, were detailed to patrol the Atlantic coast, and the other three to search to the eastward of the Windward Islands.

At least four of the five scouts were confined to fixed areas by orders of the Navy Department, and two were given exact instructions as to position, speed, and course by like orders.

[1] MacArthur: "Life of Nelson."

The Russo-Japanese War, again, furnishes evidence of the moral effect, on the commander in chief, of the lack of information concerning the enemy.

Even after the Russians had practically announced their line of approach, Admiral Togo suffered for days due to lack of information of the Russian fleet. One of his aids writes as follows:

> The time when we felt the greatest anxiety was two or three days before the battle. We had expected the Russian fleet to be sighted by our southernmost vessels by May 23, or at least 25, but no report came from them, nor did we receive from any source any information about the Russian fleet. Now, we began to doubt whether the enemy had not entered the Pacific and gone round to the Strait of Soya or Tsugaru. Being in the dark as to the route the enemy had taken, it was the most trying time for us. Even Admiral Togo, although very strong in his conviction that the enemy must come by Tsushima, seemed to have felt a certain uneasiness at the time.

These historical illustrations have been cited to bring home the necessity of accurate, timely information in the conduct of naval war. The radio and cable have facilitated the transmission of information, but steam has decreased the time taken for operations.

The statements of great military writers concerning the value of information are equally true to-day; but, conclusive as such statements should be, no one fully realizes their truth until subjected in war or its minor counterparts, maneuvers with the fleet, or chart maneuvers, to the trials, uncertainties, and disappointments that accompany lack of accurate, timely information of the enemy.

CHAPTER III.

TYPES OF NAVAL CAMPAIGNS—DEFINITIONS.

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DEFINITIONS.

STRATEGICAL OFFENSIVE AND DEFENSIVE.

A force is acting on the *strategical offensive* when its operations are projected into an area:

(*a*) Which is not normally controlled during peace.

(*b*) Which has not been previously prepared for defense by the force so acting.

The strategical offensive in the campaigns in which we may engage will be undertaken with a view to seizing a base within enemy jurisdiction, or a base within national jurisdiction, but within an area which has not been properly prepared for defense during peace, and which may, therefore, be taken and held by the enemy previous to the arrival of our fleet.

A fundamental requirement of successful offensive strategy is a marked superiority, for the difficulties attending the capture of a base, the maintenance of the lines of communication, and the absence of proper docking and repair facilities, are factors which rapidly reduce the efficiency of the offensive fleet.

A force is acting on the *strategical defensive* when its operations are confined to an area which:

(*a*) Is normally controlled during peace.

(*b*) Has been taken from the enemy and prepared for defense.

As has been said, a fundamental requirement of the strategical offensive is a marked superiority. It is equally true that inferiority is, while not a requirement, usually a condition of the force acting upon the strategical defensive.

In the present European war the Allies' fleet is operating on the strategical offensive against Turkey and Austria. The Turkish and Austrian fleets are acting on the strategical defensive.

The operations of the German and British fleets are less consistent with either type of operation, but considering the entire naval forces, it may be said that the British fleet is acting on the strategical offensive against Germany, and the German fleet is acting on the strategical defensive with regard to Great Britain and on the strategical offensive with regard to Russia.

DIFFICULTIES OF STRATEGICAL OFFENSIVE IN OVERSEA CAMPAIGN.

The strategical offensive, in the case under consideration, has many serious disadvantages, not the least of which is the necessity for carrying fuel and supplies with the fleet. The tactical, as well as strategical, handicap imposed on a fleet by an enormous train of slow moving, indifferently handled auxiliaries, will be very great.

The successful termination of the first campaign may rest upon the ability of this force to evade the enemy until the train can be deposited in an advanced base.

OUR SITUATION.

A study of our situation, geographical and political, will show that in the Atlantic we must be prepared to locate the enemy fleet and bring it to action before its train can be placed in safety in some advanced base, but in the Pacific we must be prepared to deny information of the movements of our main body and train until our train can be placed in safety in an advanced base.

To few other nations must the operations of scouting and screening play such an important part in any war, and yet the number and types of vessels we have available for this service most surely point to a failure in such operations.

A good workman with poor tools may attain a higher efficiency than a poor workman with good tools, only by the application of superior knowledge and dexterity. So it must be with us. If we hope to compare in efficiency with our adversaries, we must have superior knowledge of the work to be done, and sufficient exercise to create the ability to use such knowledge.

An efficient secret service, both secret agents and spies, must be laid down in time of peace.

The Navy must appreciate the value of information in war, become efficient in scouting and screening operations, and learn the value of such operations.

TYPES OF NAVAL CAMPAIGNS.

In general terms, naval campaigns may be divided into three classes:

(*a*) Those in which both fleets are handled offensively.

(*b*) Those in which one force is seeking to reach some geographical objective, the opposing force attempting to interpose between such force, and its geographical objective.

(*c*) Those in which the opposing naval forces are based in close proximity, but, through differences in types or total strength, one force does not desire a major action.

In campaigns of class (*a*), in which each fleet is operating offensively, the operations will be along the following lines:

1. Search operations to find the enemy. Protective scouting in the vicinity of the main body. Main body proceeding to general vicinity of the enemy.

2. The force which first gains touch with its enemy's main force will advance its destroyers to make a night attack. Scout protectively for the enemy destroyers, and advance its own main force as close to the enemy main force as can be done without danger of subjecting it to attack by the enemy destroyers.

3. If the destroyer attack is successful, a major action should be forced upon the enemy during the suceeding daylight.

If the destroyer attack is unsuccessful, major action should be refused and the destroyers given another chance, or the main force should fall back upon the coast to gain the advantage of coast submarines and torpedo boats.

4. The defeated fleet will fall back upon its home coast. The successful fleet will seek a base on or near the enemy coast, after which the operations take form (*c*).

OPERATIONS IN CAMPAIGNS OF TYPE (b).

On the largest scale this form of campaign is exemplified in the movement of a large naval force oversea with the mission of securing an advanced base for future naval or military operations.

On a minor scale this form of campaign is exemplified in all cases of escorting a convoy, in forming junctions with other forces, in the relief of ports threatened by military operations, etc.

On account of the distance that separates us from any of our probable adversaries, the opening campaign in any war in which we may engage will almost certainly be of this nature.

It is probable that in a war with any European power our naval force would act on the strategical defensive, and our primary mission would be to defeat an enemy who would be attempting to seize an advance base in or near our home territory.

In the Pacific, the situation is reversed, for we would be required to operate on the strategical offensive to assure the successful outcome of the war.

An example of such a campaign is the movement of the Russian fleet from Libau to Tsushima. Vladivostok was the base to which the Russian fleet was bound when the Japanese fleet interposed between it and its prospective base and defeated it.

OPERATIONS OF THE STRATEGICALLY OFFENSIVE FORCE.

As has been said, a fundamental requirement of successful offensive strategy is a marked superiority. To be entirely successful, this

superiority should exist not only in the fighting force but also in the types especially designed for the service of information and security.

The primary mission of such a strategically offensive force is to secure a base and, consequently, can be accomplished if the enemy is not encountered.

The strategically offensive fleet will therefore endeavor to evade major action and, to accomplish this task, will find it necessary to deny information to the enemy.

The operations of this force will consist in offensive or protective screening operations.

If this operation is successful, the mission will be accomplished, but if the enemy interposes, it will be necessary to assume the tactical offensive, in which case the screening force will assume the duties of a scouting force and the operation will be as explained in type (a).

OPERATIONS OF STRATEGICALLY DEFENSIVE FORCE.

The fleet operating on the strategical defensive, having for its mission to locate and defeat the offensive force, must—.

1. Search for the enemy.

2. Scout strategically to gain information upon which is to be based the strategical operations of its main force.

3. Scout tactically for the benefit of its destroyers, which should be advanced to attack. Continue tactical scouting if main force is to engage. Revert to strategical scouting if main force is not to engage.

4. The main force of the defensive fleet should bring on a major action as soon as the enemy's superiority has been reduced by destroyer attack. If this superiority has not been reduced the major action should be brought on in such a position near the coast that the defensive fleet may obtain the greatest benefit from its coast submarines and torpedo boats.

OPERATIONS IN CAMPAIGN OF TYPE (c).

When the major forces are based in close proximity and the differences in types or total strength is such that one force declines a major action the operations will usually be limited to the following:

Fleet superior in major ships.—Distant blockade, accompanied by observation of enemy ports and such torpedo and mining operations as may be found practical.

Fleet superior in torpedo craft or of inferior total strength.—Operations by torpedo craft and mines to reduce the enemy's superiority.

The naval campaign now in progress between the naval forces of Germany and Great Britain is of this nature.

DEFINITIONS.

Before proceeding with a further discussion of the operations of naval forces in the service of information and security, the terms used in such discussion will be defined.

SCOUTING.

Scouting.—Operations by a naval force to obtain information of the enemy. There are five distinct types of scouting operations:

1. Scouting to find the enemy, called *search.* This operation is aggressive. It is based upon information received from spies, secret agents, or from observation forces which are of insufficient strength to track the enemy. The information obtained is used as a basis for strategical scouting operations.

2. Scouting, when in contact with the enemy, called *contact scouting.*

Contact scouting is of two types: (a) *Strategical scouting* and (b) *tactical scouting.*

(a) *Strategical scouting.*—Operations after a contact with the enemy's main force or its screen, before one's own main force, or other force detailed to attack, is within striking distance, to determine the general direction of movement, composition, and disposition of the enemy's main force and its screen. Upon the information thus obtained are based the strategical operations of the attacking force with a view to assuming the tactical offensive.

(b) *Tactical scouting.*—Operations when the main force, or other force detailed to attack, is within striking distance, to obtain constant information of the location of the enemy's main force, its strength and disposition; upon the information thus obtained are based the later offensive tactical operations of the attacking force.

3. *Protective scouting.*—Scouting operations confined:

(a) To insuring the absence of the enemy from areas from which the main force may be threatened.

(b) To obtaining just sufficient warning of the enemy's proximity to facilitate evasion or to assure adequate time for taking up battle formation.

4. *Observation.*—Operations within a fixed area, or on a fixed line, with a view to ascertaining the presence of the enemy within, or his absence from, that area, or his passage of this fixed line.

This term usually implies that the area or the line is selected for its geographical position rather than based upon information of the enemy's movements, but, as in the case of a force observing a port in which the enemy is known to be, the selection of the area may be based upon information of the enemy fleet.

5. *Reconnoitering.*—To reconnoiter means to view for the purpose of obtaining military information.

This verb has, by common usage in the Navy, come to mean the determination of details of information concerning localities or forces. It applies to the determination of detailed information rather than to discovery. It is distinguished from *observation* in that it implies an act or possibly repeated acts, but not a continuous operation.

A scout.—Any ship engaged in an operation of which the mission is to gain information of the enemy, either positive or negative.

A scouting line.—Several scouts disposed along a line either straight or curved.

The scouting line, *or scouting line.*—The true bearing of the guide of a line of scouts from all other scouts of the line; the line of bearing of the scouts.

Scouting distance, *or distance.*—The distance between adjacent scouts of the same line, expressed in miles.

Scouting speed.—The speed to be used by the scouts while scouting, expressed in knots per hour.

Scouting bearings.—Ships are sometimes directed to scout protectively ahead or on the flank of the main force. If such ships are formed on a line, the bearing of the center of the scouting line from the fleet guide is called the "Scouting bearing."

Scouting interval.—The distance from the center of the scouting line to the fleet guide is called the "Scouting interval."

Tracking is the operation of maintaining contact with an enemy force. It does not necessarily imply following; tracking may be accomplished from ahead or from a flank.

Trailing is the operation of searching from the rear, or keeping touch from the rear, i. e., following.

A position circle is the locus of position points of a force which has steamed from a known position a known distance; it is a circle described with the point of departure as a center and the distance steamed as a radius.

A-knot position circle is a position circle of which the center is the enemy's point of departure and of which the radius is equal to the number of hours since enemy left known point of departure multiplied by the enemy's speed in knots per hour.

Offensive screening.—Operations at a distance from the main force, with a view to destroying or containing the enemy scouting force, thus affording security to one's own main force.

Protective screening.—Operations at a short distance from the force screened with a view to denying information of its exact position by preventing any enemy scouting force reaching a position from which the smoke of the force screened can be seen.

Defensive screening.—Operations in close proximity to the main force to disclose the approach of enemy vessels, especially torpedo craft, and to aid in destroying such enemy vessels when sighted.

Range of visibility is the distance at which the object sought may be seen. This varies with the nature and number of the objects looked for and with the weather conditions.

Radius of visibility is the distance that can be observed in any direction. This varies with the nature and number of the objects looked for, and with the weather conditions.

Smoke touch or smoke contact means that the smoke of an enemy force is visible.

Contact is established when enemy ships have been sighted.

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CHAPTER IV.

THE SEARCH.

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THE SEARCH.

Harrington Emerson, the well-known efficiency expert, has so studied and analyzed the subject of personal efficiency that he now considers it possible to state 13 definite principles. He says:

> Seekers for truth had to dig out and compare thousands of detached bits of knowledge about electricity before men learned that high-voltage currents can be carried long distances on comparatively small wires with but little loss.
>
> The boy learns this in 15 minutes' hard study. It not only gives him essential knowledge about all the experiments the original investigators made, but forms the basis of thousands of new practical applications.
>
> This wonderful short cut to knowledge is a statement of principles.
>
> Similarly you can find short cuts to skill.
>
> It took years of training for the Wright brothers to learn to fly, but when they had worked out the principles they were able to give others the necessary training in a few weeks.

Searching is not yet a science. There is still much to do in the study and analysis of such operations, but unless individual investigators place the principles they have deduced where they may be examined, tried, and tested no progress will be made.

PRINCIPLES OF SEARCH.

To perform efficient search operations—

1. Make use of all available information of the enemy and of own forces.

2. Decide upon the areas in which search may be profitable and the time at which the enemy may be within these areas.

3. Cover the enemy's most probable area and as many other areas as possible; cover the most probable area first when the searching force is strong, or the information of the enemy is required immediately; cover the less probable areas first when the searching force is weak, or the information is not required immediately.

4. Use the simplest method which—

(*a*) Covers the selected area in a manner effective for the assumed range of visibility of the force for which the search is being conducted.

(*b*) Maintains an efficient concentration; and

(*c*) Is consistent with the speeds of available vessels, their radii of action with the amount of fuel on board, and conditions regarding future fuel supply.

These principles are general and that most officers know them is true, but that they are often violated in chart maneuvers and even in maneuvers at sea is also true, and this is the reason for stating them.

In the past year there have been cases where—

1. Vital information of the enemy was overlooked or neglected.

2. Scouts have been sent to search in areas which it was a physical impossibility for the enemy to have reached at the time the vessels were searching.

3. The third principle has been violated by using weak, slow, second-class cruisers to locate a force screened by fast armored cruisers or first-class protected cruisers, when negative information, i. e., information of the enemy's absence from a given locality, would have been equally valuable.

4. The fourth principle was violated by using a complicated method or inefficient concentration, and in some maneuvers forces have run out of fuel through the use of methods that were inconsistent with their fuel supply.

INFORMATION DESIRED IN PLANNING SEARCH OPERATIONS.

Consider first what information would be desired in planning a search. Much of it may not be available, but all that is available should be used.

1. What is the nature of the force to be searched for? Main body, transports, convoy, raiding forces, etc.

2. What is its position, composition, intention, probable destination?

3. Of what strength is this enemy force? That is, of what types composed? What speed? What radius of action? Is the fighting force tactically handcapped by a train or convoy? Is the force stronger by day or night? Will the force be strong enough to screen offensively, protectively, or only defensively?

4. How does the scouting force compare with that of the enemy's probable screen in strength? In speed? In numbers?

5. What is the probable maximum speed of the enemy's slowest vessels?

6. How will the normal weather and sea conditions affect his speed? His visibility? His choice of route?

7. What strategical influence does this force exert on other enemy forces; on our own force; i. e., is it so important that the

enemy main force will act in conjunction with it? Will it be reinforced? Will its movement affect our main force? How will it affect our forces?

Much of this information should be on record, i. e., normal weather and sea conditions, speeds, radii of action, armament, and armor.

For some of it we rely on spies, secret agents, or previous contacts, or on our campaign order, i. e., nature of force, position, composition, speed of force.

The general situation should indicate: The intention and probable destination, the strategic influence of the force.

Our campaign order should indicate our mission (the task we are to perform), the influence of our operations on our own forces.

With all this information at hand we estimate the situation. This estimate should lead to a decision as to—

(a) The enemy's probable intentions.

(b) The enemy's most probable route; his possible routes.

(c) The enemy force's maximum speed.

(d) The areas in which scouting may be profitable and the times at which the enemy may be within these areas.

(e) The enemy's probable screening operations.

(f) The relative strength of the forces opposed.

With these decisions in view, select the simplest method of search which:

1. Will cover the desired area efficiently.
2. Is consistent with the speeds and fuel supply of the available scouts.
3. Assures effective cooperation or concentration with our other forces.

How are we to decide which is the simplest efficient method?

The only answer is: By experience in the conduct of search operations.

WRITTEN STANDARD PRACTICE INSTRUCTIONS.

Harrington Emerson's seventh principle of efficiency is: "* * * make, study, and follow written standard practice instructions."

He says:

> Written standard practice instructions bring down to us in definite, concrete, and practical form the results of the study, thought, experience, and observation of others, and crystallize and make practicable the results of our own thought, study, experience, and observation, * * * aid us in standardizing our mental conditions, and * * * serve as a rachet to our progress.

In the remainder of this work in scouting and screening the aim has been to assemble a set of written standard practice instructions, to "bring down to us in definite, concrete, and practical form the results of the study, thought, experience, and observation" of those

who have given much time to the practice of these operations in chart maneuvers and in the fleet.

In many respects these instructions are incomplete and even may be in error, but they have helped to standardize the mental conditions of those who have used them, and may "serve as a rachet to our progress."

FORMS OF SEARCH OPERATIONS.

There are three general forms of search operations:

(a) The search from ahead.
(b) The search from a flank.
(c) The search from the rear.

The form of search to be employed depends on many factors, such as:

1. Area to be searched.
2. Number of scouts available.
3. Position of the scouts with regard to the area to be searched.
4. Maximum sustained speed of the scouts.
5. Amount of fuel on board.
6. Availability of future fuel supply.
7. Relative strength of scouting force and enemy's probable screening force.
8. Location of the attacking force.

The first point to be determined in any situation is the area to be searched.

A careful estimate of the situation should be made to determine the enemy's probable intentions, and the alternate courses of action that appear possible for him to adopt.

If the enemy is known to have left a certain point at a known time, circles may be drawn representing the locus of his possible positions at each daylight for any assumed speed. Drawing these circles for his highest and lowest assumed speed, for daylight and dark, an area is determined in which search is profitable.

Searching an area which the enemy could not have reached at his maximum speed is wasted energy. Searching is only profitable during daylight, and only under special circumstances can it be justified at night.

Each area covered should be searched thoroughly. Negative information is valuable. Indifferent search is wasted energy, for no deductions can be drawn from such work.

The aid rendered by a well-organized intelligence service is here very well marked, for if the enemy's exact force is known, his speed may be closely estimated, and if his objective is known, the area to be searched may be greatly reduced. Such decrease in area to be

searched, increases the strength in the searching area and greatly augments the chance of success.

The number of scouts may have a material effect on the method to be used. The area covered by the search from ahead is very small. The same number of scouts using some form of the search from the flank can cover a much greater area if they have sufficient speed and endurance.

The number of scouts is but one of the many factors, as has been shown above.

The position of the scouts with regard to the area may influence the method. If astern, the search from ahead can not be used until the scouts gain a position ahead. If on the flank, some form of the search from the flank is advisable.

The relative position of the scouts and enemy may be the determining factor in the choice of form of search.

The maximum sustained speed may be the determining factor between the search from ahead and some form of the search from the flank.

The amount of fuel on board may prohibit the use of speed high enough for the search from the flank or from the rear.

Availability of future fuel supply may also have an effect upon the speed that can be used by the scouts.

If the enemy's screening force is strong and fast it may be necessary to have a great concentration of the scouting force, or it may be advisable to seek negative information until the attacking force approaches.

As has been mentioned, the position of the attacking force may have a deciding effect upon the method. If early information is desired the method may be quite different from that used if negative information is desired.

In general, the forms of search are applicable to strategical scouting, also, and, in view of the importance of the geometrical methods which have been developed, it is necessary to counteract the tendency to decry such methods.

FALLACIES WITH REGARD TO GEOMETRICAL METHODS OF SCOUTING.

There are two fallacies with regard to the use of geometrical methods in scouting which must be disposed of before a whole-hearted interest can be developed in this study.

The first fallacy is: Ships can not in practice make their actual courses conform to the lines required in geometrical methods.

The successful application of these methods by ships of the fleet in the past few years should put an end to this fallacy. In nine

operations in the fleet during the last four years the efforts of the searching force have met with success. In but two such effort failed. In one of these two cases fog made any search impracticable, and in the other the destroyers, which, for want of proper scouts, were used as scouts, were forced to seek shelter due to bad weather.

The geometrical methods of scouting are but systematized operations, and manifestly better results will be obtained with a system than if a system is lacking.

Lack of system results in such abortive operations as the search for the Confederate brig *Tacony*, in which about 50 ships, most of them steamers, searched for this brig in the area between Hampton Roads and Portland, Me., for about two weeks without locating their prey; the operations of our merchant scouts during the War with Spain when their operations were directed from the Navy Department 1,500 miles away; and the operations of one group of scouts in the maneuvers of the winter of 1902, when this group was ordered to observe a certain area until a fixed time and then withdraw, the time set for withdrawal being so early that the enemy could not have reached the area by such time, even at its maximum speed.

The other fallacy is: In practice the information will not be as exact as it is in problems, and, therefore, these methods will be of no use.

There are two reasons why this fallacy must be exterminated:

1. Wireless has increased the ranges and rates of transmission of information beyond the wildest dreams of those from whom this tradition descended.

2. Information is vital to success. To obtain information the enemy must be located. To locate the enemy certain areas must be searched. Having selected the areas to be searched, the ships must be given instructions and the area searched systematically. Geometrical methods furnish the simplest means of indicating the operation to be conducted, and, when understood, offer the most efficient method of covering the desired area.

In order to train officers in the use of the methods which have been developed, the assumptions given in the problems are usually correct, and the proper use of the scouting force should lead to success in the maneuver.

A professional golf player does not first instruct a novice in the execution of a shot from a cuppy or an overhanging lie. The conditions are made perfect until a considerable amount of skill is acquired.

In war, the best planned operation may go astray through errors in the information or assumptions of the commander. In training, well-planned operations should meet with success.

Above all, some area must be covered no matter what the assumptions are, and geometrical methods will indicate the best, easiest, and quickest way to cover the desired area.

Having discussed the general nature of search operations, the geometrical methods of search will be explained:

These methods are:

The search from ahead, called *ahead search*, or *out-and-in method.*

The search from the flank, comprising:

(*a*) *Independent method* of retiring search.

(*b*) *Sector method* of retiring search.

(*c*) *Patrol method* of retiring search.

The search from the rear, called *trailing.*

The *direct method*, which may take the form of the daylight operation of any one of several of the above types. In the direct method new orders are issued for each dark and daylight period.

CHAPTER V.

THE SEARCH FROM AHEAD.

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THE SEARCH FROM AHEAD.

Search operations are usually conducted by the force acting on the strategical defensive. This implies that the enemy is moving toward the area in which the fleet operating on the strategical defensive is based. In most cases, therefore, the scouting force is in position to search from ahead if it desires to do so.

This form of search has been, in the United States Navy, called the "Out and in" method from the nature of the movement of the scouts, toward the enemy (out, away from their own base) during daylight, and away from the enemy (in, toward their own base) at night or during unfavorable weather conditions.

As the name of the method implies, the line of scouts must always be formed ahead of the enemy; that is, between the enemy and his destination.

HOW TO FORM THE SCOUTING LINE.

In searching from ahead, the scouts are usually formed on a straight line, the line of bearing of the scouts being at approximately 90 degrees, that is, normal, to the assumed direction of the enemy's approach. That the line of scouts should be straight is not a necessity, though by being straight and normal to the enemy's assumed course, it covers the widest front. If the line is curved, it is usually concave toward the enemy's assumed position. Scouts are frequently formed thus on an enemy "position circle."

The scouts steam at equal speeds, on routes which are usually parallel to each other and to the assumed course of the enemy, to the front (toward the enemy) during daylight, when the visibility conditions are good, and to the rear (away from the enemy) during darkness, fog, heavy rain, snow, or other weather conditions which seriously reduce the radius of visibility.

The distance between scouts should not be greater than twice the assumed range of visibility of the smoke of the force for which the search is being conducted unless the conditions require the enemy to use an extensive protective screen. In any case the maximum distance at which scouts can be effective depends upon the weather conditions, the number of ships in the enemy force, and their disposition.

Scouts should not be spaced at the maximum effective distance if the number of scouts available is sufficient to search the desired area at a reduced distance. Reduction in distance, by increasing the concentration, gives greater efficiency for strategical scouting after contact is made.

WHERE AND WHEN TO FORM THE SCOUTING LINE.

The line must be formed between the enemy and his destination. Before a decision can be made as to when and where this can be done the following must be known or assumed:

1. The enemy's—

(a) Point of departure.

(b) Earliest time of departure.

(c) Destination.

(d) The general direction of approach to his destination or general direction of movement from his point of departure.

(e) Maximum sustained speed.

2. The scout's—

(a) Point of departure.

(b) Maximum sustained speed.

(c) Conditions as regards fuel endurance and supply.

Having answered these questions exactly, or made reasonable assumptions, draw roughly on the chart "position circles" from the enemy's point of departure, assuming his earliest possible hour of departure and his maximum speed. Draw also simultaneous "position circles" for the scouts, for their earliest hour of departure and their maximum sustained speed. The arc between intersections of the two position circles for a given time indicates the limiting positions between which the scouting line may be efficiently formed at that time.

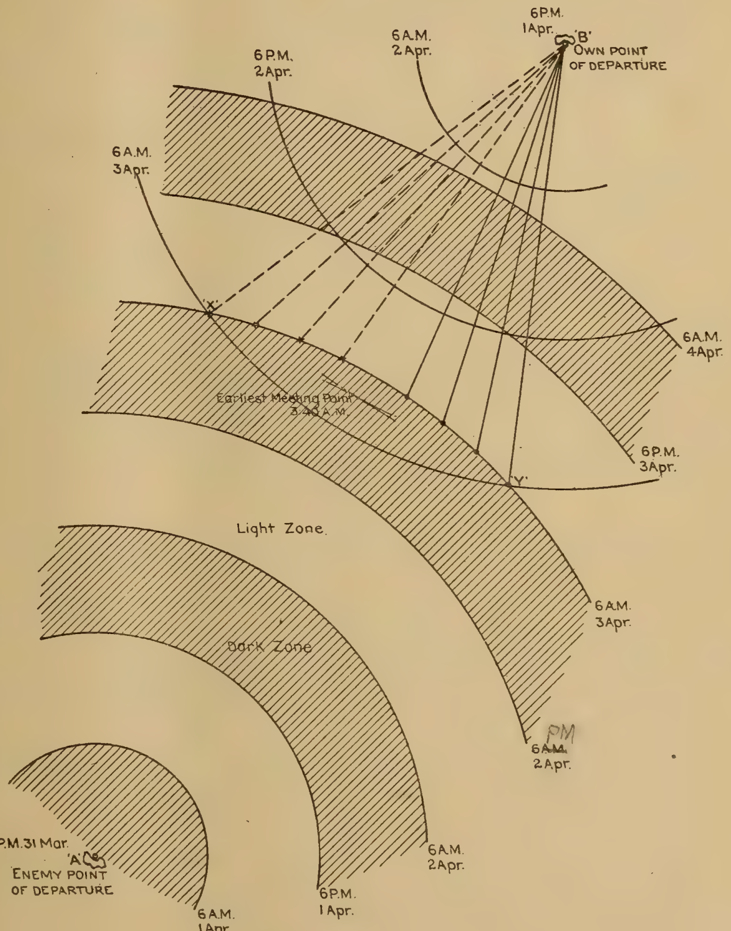
Example—Sketch 1.—The commander of a group of 4 scouts at B learns on 1 April, 5 P. M., that an enemy force, whose estimated maximum speed is 12 knots, left A on 31 March, 6 P. M.

Position circles for the enemy are drawn for daylight and dark, assuming the enemy to use his maximum speed, 12 knots, and the daylight and the dark zones are clearly marked.

Assuming the scouts' earliest hour of departure as 1 April, 6 P. M., and their maximum sustained speed as 20 knots, the scout commander lays off "position circles" from the scouts' point of departure for the same times.

The position circles for dark, 2 April, 6 P. M., do not intersect; there is, therefore, no chance of a contact previous to that time.

The earliest meeting point is the time at which simultaneous position circles for the two forces become tangent, in this case about



SKETCH No. 1.
Example of daylight and dark circles and limiting positions for scouting lines.

3 April, 3.40 A. M., but due to the darkness it would be unprofitable to attempt to commence the search at that time.

At daylight the two simultaneous position circles intersect at the points X and Y. The arc of the enemy's position circle lying between the points X and Y indicates the limiting positions of the scouting line for daylight 3 April.

This arc X Y is about 460 miles long; too great for 4 ships; the scout commander must, therefore, decide whether to cover the northern, southern, or central portion of the line. If he decides on either of the flanks, one scout must steam at its maximum speed to reach its position. If he decides on the central area, all scouts may reduce their speed to arrive on the arc X Y at daylight.

The scouts can be disposed on the enemy's daylight curve, but for simplicity the line is generally made straight, tangent at its center to the position circle.

If the simultaneous position circles of the enemy and scouts had been tangent during daylight, the scouting line would probably have been formed during the day at, or soon after, the time of such tangency.

If the conditions are such that not all of the scouts can reach their assigned position during daylight, it is advisable, unless there is great urgency for the information, to form the line at the following daylight, thus, by running at a reduced speed, saving fuel and reducing the chances of breakdown of the scouts.

DETERMINING POSITION AND BEARING OF SCOUTING LINE.

Having decided upon the enemy's destination and probable route, the bearing of the scouting line is determined, the line usually being at right angles to the direction of movement of the enemy.

The time the line is to be formed is then chosen, the practicability of the decision being tested by noting if the distance to be run by the scout whose assigned position is most distant from its point of departure, is less than the radius of its maximum speed position circle for the time at which the line is to be formed.

Locate a point on the line accurately, either by mercator sailing or graphically on a chart. Use the bearing from the enemy's point of departure as a course. Use as a distance run, the number of hours, between the time at which the line is to be formed and the enemy's earliest time of departure, multiplied by the enemy's assumed maximum speed per hour.

The positions of the other scouts can be fixed by the bearing of the line and the scouting distance, the line on the chart being drawn through the position previously determined.

TYPES OF ORDERS AND METHODS OF CONDUCT.

In orders for the "Search from ahead," the line as established by the order is the line of reference. An order may read:

(*a*) Advance the line (number of miles per day may be indicated).

(*b*) Maintain the line.

(*c*) Retire the line (number of miles per day may be indicated).

In cases (*a*) and (*c*), when the advance or retirement in miles is stated, the reference line is moved each 24 hours in accordance with the orders, whether or not the scouts have actually arrived at the desired position.

In case (*b*) the line established by the order remains the reference line until it is changed by further orders.

When, during a 24-hour period, the distance steamed to the front is greater than the distance steamed to the rear the line has been *advanced.*

The *advance* is the distance that the position of the line at the time considered is in advance of its position 24 hours previous. The time at which the line is originally formed is usually considered as the base time for this calculation. The scouts may not, because of unfavorable conditions, be in their assigned positons. The line on the chart, the reference line, is moved in accordance with the orders, even though the scouts are not in position.

A line may be advanced to the front by using a speed in the forward movement in excess of that to be used in moving to the rear, or, when daylight is longer than darkness, by using a constant speed.

NOTE.—In the movement to the rear scouts steam at the enemy's assumed maximum speed.

Example.—Scouts' maximum sustained speed, 20 knots. Enemy's assumed maximum, 15 knots. Advance to be 50 miles per day. Daylight 13 hours, darkness 11 hours. S = speed to be used in forward movement.

$S \times 13 = (11 \times 15)$ movement to rear $+ 50$ (advance).

$13\,S = 215.$

$S = 16.5$ knots.

When, during a 24-hour period, the distance steamed to the front is equal to the distance steamed to the rear, the line is maintained.

Example.—Scouts' maximum sustained speed, 20 knots. Enemy's assumed maximum, 15 knots. Line to be maintained. Daylight 13 hours, darkness 11 hours. S = speed to be used in forward movement.

$13\,S = 11 \times 15.$

$13\,S = 165.$

$S = 12.7$ knots.

When, during a 24-hour period, the distance steamed to the front is less than the distance steamed to the rear, the line is retired.

The retirement is the difference between the distance steamed to the rear and that steamed to the front.

Example.—Scouts' maximum sustained speed, 20 knots. Enemy's assumed maximum, 15 knots. Line to be retired 50 miles per day. Daylight 13 hours, darkness 11 hours. S=speed to be used in forward movement.

$$S \times 13 = 11 \times 15 - 50 \text{ (retirement)}.$$
$$13\,S = 115.$$
$$S = 8.8 \text{ knots}.$$

The efficiency of the search takes precedence over blind obedience to search orders. The order is a guide which should be followed unless new conditions arise which require a change or modification of the plan to accomplish the end in view.

Motive-power accidents, or a reduced radius of visibility due to haze, mist, rain, snow, or fog, are some of the conditions which may interfere with the prescribed plan.

Frequently it will be impossible to carry out the instructions, due to some of the above conditions. The speeds and courses must be changed to accommodate the movement of the scouts to the new conditions.

UNFAVORABLE CONDITIONS ENCOUNTERED BY PORTION OF FORCE.

When unfavorable visibility conditions are encountered the scouts should move to the rear on a course parallel to the enemy's assumed course, at the enemy's assumed maximum speed. This movement will prevent the enemy passing through the scouting line during the unfavorable conditions.

It is possible that these unfavorable conditions may be encountered by only a portion of the line of scouts. The scout, or scouts, encountering such conditions should immediately change course to the rear and report their action and the cause of their change of course to the scout commander.

The scout commander must then decide whether or not it is advisable to move to the rear with all the scouts.

If the scout commander decides to move all scouts to the rear, which is the correct decision if it can be done without decreasing the efficiency of the search plan, he should send a radio to such scouts as are still steaming to the front, directing a time at which they are to move to the rear and the speed to be used in this movement.

The speed assigned should be such that by the following daylight the scouts will be re-formed upon the proper line of bearing from the

scout which first started the movement to the rear. As the scout which first moved to the rear will be many miles in rear of the other scouts by the time they execute the order to steam to the rear, it is impracticable to re-form the line before the succeeding daylight, because the speed of the scouts would probably be too low, and, even if it were possible to re-form the line, the fuel consumption would be excessive.

If, after encountering unfavorable conditions, the conditions become favorable, the scouts should immediately report the fact, but should not steam to the front until directed to do so by the scout commander. An exception is made in the case of a scout which, through early movement to the rear, is in rear of the line of scouts. Such scout should during favorable conditions steam to the front until his position in the line is reached. He should then continue the movement to the rear.

In the previous examples, where the speeds were determined, darkness only was considered. Consider the differences in speed required in the forward movement of a group of scouts which have been steaming to the rear during the night and when, before daylight, the scout commander has learned that all the scouts are in a dense fog.

He directs them to continue the movement to the rear at 15 knots, the enemy's assumed maximum speed.

Daylight, 5.30 A. M. to 6.30 P. M.

By 7 A. M. he has received radio messages from all scouts that conditions are again favorable.

He directs that at 7.30 A. M. the course will be reversed and the scouts steam to the front. What speed should be set under the previous orders?

Example 1.—Line to advance 50 miles a day.

	Movement.	
	To front.	To rear.
		Miles.
5.30 to 7.30 A. M	....	30
To the rear at night	....	165
Line to advance, equal to	....	50
	....	245

Hours remaining, 11.

$$\text{Speed}=\frac{245}{11}=22.3 \text{ knots.}$$

This speed is in excess of the maximum sustained speed, so 20 knots, the maximum, is used. The line can be advanced only 25 miles on this day.

Example 2.—Line to be maintained.

	Movement.	
	To front.	To rear.
		Miles.
5.30 to 7.30 A. M		30
To the rear at night		165
		195

Hours remaining, 11.

$$\text{Speed}=\frac{195}{11}=17.6 \text{ knots.}$$

Example 3.—Line to retire 50 miles a day.

	Movement.	
	To front.	To rear.
	Miles.	*Miles.*
5.30 to 7.30 A. M		30
To the rear at night		165
Line to be retired, equal to	50	
	50	195
		50
		145

Hours remaining, 11.

$$\text{Speed}=\frac{145}{11}=13.2 \text{ knots.}$$

THE EFFECT OF ERROR IN ESTIMATING ENEMY COURSE AND SPEED.

The effect of error in estimating the enemy's course is dependent upon the number of scouts available. With a limited number of scouts, the area that can be covered is also limited. If the error has been so great that the enemy does not pass through the area occupied, the search will be unsuccessful.

The effect of error in estimating the enemy's speed may, if this speed is estimated below the actual, cause an error in the time at which the line is to be formed and might permit the enemy to pass the scouts before the line is formed.

To be sure that the line is formed in time and that the enemy does not pass through the line of scouts unobserved, the scouts must form the line on the assumption of enemy maximum speed and earliest hour of departure, and must move to the rear parallel to the enemy's assumed course, at the enemy's maximum speed, during darkness, fog, or other unfavorable conditions which seriously reduce the radius of visibility. This movement to the rear at the enemy's maximum speed

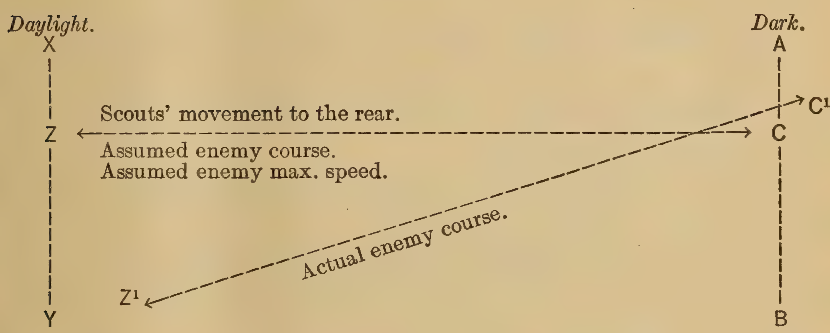
on his assumed course, prevents the enemy passing the line of scouts while the radius of visibility is reduced.

In the movement to the rear, mentioned above, the enemy's course and his maximum speed have been assumed. What effect would an error in our estimate have on the efficiency of the search?

THE EFFECT OF AN ERROR IN ENEMY'S ASSUMED COURSE.

Assume an error in course as indicated:

DIAGRAM 1.

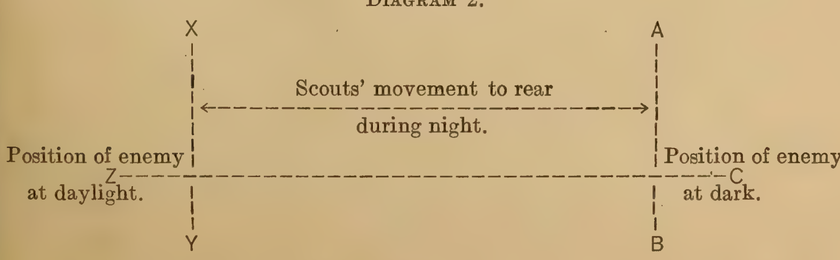


In Diagram 1, A B represents the position of the line of scouts at dark, X Y the position of the line of scouts at the following daylight, C Z the actual movement to the rear of the scouts, C′ Z′ actual enemy movement in direction and distance. Assuming that the speed of movement to the rear is correct, it is evident that an error in the assumed course does not affect the efficiency of the search, unless the error is so great that the enemy force moves during the time of reduced visibility, outside the area which will be covered by the scouts during their movement to the front on the succeeding day.

EFFECT OF ERROR IN ENEMY'S ASSUMED MAXIMUM SPEED.

If at dark the enemy was just out of sight, ahead of the line of scouts, it might be possible for him to pass through the line undetected during dark, if the assumed speed of the enemy was much below his actual speed.

DIAGRAM 2.



In Diagram 2, A B is the position of the line of scouts at dark; C, the position of the enemy at dark; X Y, the position of the line of scouts at daylight; Z, the position of the enemy at daylight.

In this case the assumed speed of the enemy was so much below the actual that the enemy passed through the line of scouts during the night.

To be sure that the enemy does not pass the line of scouts during the night, the speed used in the movement to the rear should be equal to the maximum rated speed of the enemy force for which the search is being conducted.

THE SEARCH FROM AHEAD IS MOST ADVANTAGEOUS.

1. In searching an area where there is reason to believe that the enemy must cross the line of scouts; as when the enemy is leaving or approaching a known port.

2. When the estimate of the enemy's course will probably be more accurate than the estimate of his speed.

3. When the enemy's time of departure is uncertain.

4. When the speed of the scouting force is low, or when it is essential that the least possible amount of fuel be expended.

The advantages of this method are:

1. Covers the area for all enemy speeds less than the assumed maximum, and enemy times of departure later than the assumed earliest hour of departure.

2. The speeds used are the lowest for any form of search, consequently ships not suitable for other forms of search may be used for this; there is less fuel consumption by this method than by any other.

The disadvantages of this method are:

1. Area covered is small.

2. Small area covered requires accurate estimate of enemy's course.

3. Having moved to the front during daylight, an excessive speed is required to change the area for a new assumption as to the enemy's destination.

CHAPTER VI.

QUESTIONS AND ANSWERS—SEARCH FROM AHEAD.

CHAPTER VI.

QUESTIONS AND ANSWERS—SEARCH FROM AHEAD.

Sketch 2, Page 61.

A Blue force of more than 8 ships, assumed maximum speed 12 knots, leaves APRA, GUAM, 1 August at 5.30 A. M. Daylight assumed 5.30 A. M. to 6.30 P. M.

Question 1. Draw maximum speed, daylight and dark zones, until 4 August, 5.30 A. M.

NOTES—In drawing these zones assume earth's surface as a plane.

Answer. The Blue force sailed from APRA 1 August, 5.30 A. M. Dark is at 6.30 P. M. The daylight period is therefore 13 hours, and during this period, at 12 knots, the Blue force would steam $12 \times 13 =$ 156 miles. The daylight zone for 1 August extends from the port, APRA, to a circle drawn with a radius of 156 miles.

The night zone first/second August lies between this circle and a circle, center at APRA, the radius of which is $11 \times 12 = 132$ miles greater, or 288 miles.

The daylight zone for 2 August lies between circles, the radii of which are 288 and 444 miles, respectively.

The night zone second/third August lies between circles, the radii of which are 444 miles and 576 miles.

Daylight third, radii 576 and 732 miles.

Night third/fourth, radii 732 and 864 miles.

NOTE.—In the diagram the night zones are indicated by cross-hatching.

Question 2. A division of four Orange scouts at OKINAWA learns of the departure of the Blue force from APRA, and at 2 August, 8 A. M., sails to search for Blue.

Draw daylight and dark position circles for Orange scouts at maximum sustained speed, 20 knots.

Answer. The Orange scouts leave OKINAWA on 2 August at 8 A. M., speed 20 knots. Dark is 6.30 P. M. Hours run during daylight, $10\frac{1}{2}$. Distance, 210 miles. The day zone therefore extends from OKINAWA to a circle, the radius of which is 210 miles.

The night run second/third August extends the radius $20 \times 11 =$ 220 miles. The limiting circle for daylight being 430 miles from OKINAWA.

The radii for successive dark and daylight circles are as follows:

Dark, 3 August=690 miles.

Daylight, 4 August=910 miles.

Question 3. Assuming Blue to be steaming at maximum speed, what is the earliest meeting point of the Orange scouts and the Blue force?

Answer. Mathematical determination of earliest meeting point by Mercator sailing:

Apra	Lat.$_1$ 13° ~~35'~~ 55' N.	Long.$_1$ 144° 52' E.
Okinawa	Lat.$_2$ 26° 30' N.	Long.$_2$ 128° 00' E.

L_2=26° 30' N.	merid. parts=1,639.5			Long.$_1$=144° 52' E.	
L_1=13° 35' N.	merid. parts= 807.0			Long.$_2$=128° 00' E.	
D. L.=12° 55' N.	M.= 832.5			D. Lo.= 16° 52' W.	
D. Lo.=1,012	log.	3.00518			
M.= 832.5	log.	2.92038			
C.= 309° 26'	log. tan.	.08480	log. sec.	.19702	
D. L.= 775			log.	2.88930	
Dist.=1,220 miles			log.	3.08632	

Blue sailed 1 August, 5.30 A. M.

Orange sailed 2 August, 8 A. M.

Blue sailed ahead of Orange $26\frac{1}{2}$ hours.

Blue steamed $26\frac{1}{2}$ hours at 12 knots=318 miles before Orange sailed.

Distance apart at time Orange sailed=1,220−318=902 miles.

Forces approach at combined speeds=32 miles per hour.

They will meet in $\frac{902}{32}$ hours=28.2 hours after Orange sailed.

2 August, 8 A. M.+28.2 hours=3 August, 12.10 P. M. Orange steams at 20 knots for 28.2 hours=564 miles from OKINAWA.

Latitude 20° 31' N., longitude 135° 55' E. Position of meeting point. The calculation of this meeting point by Mercator's sailing is omitted.

Question 4. The weather being clear, the assumed range of visibility of the smoke of the Blue force is 30 miles.

How, where, and when should the scouting line be formed under the following instructions:

(*a*) Search from ahead on direct route, APRA to north end of LUZON.

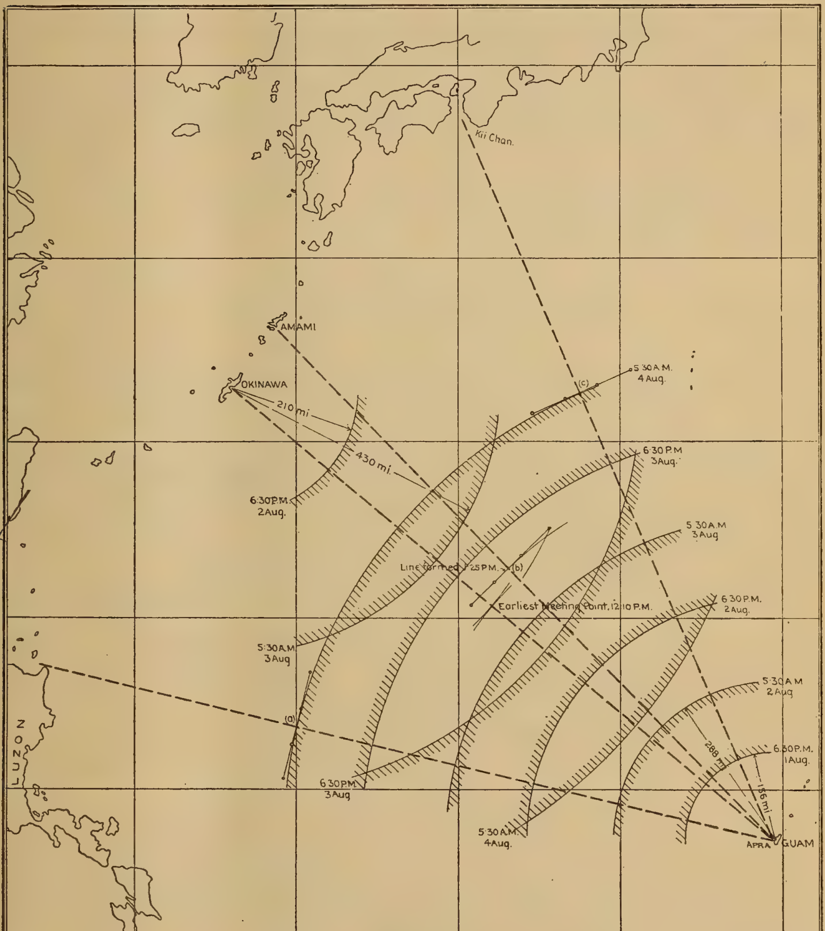
(*b*) Search from ahead on direct route, APRA to AMAMI.

(c) Search from ahead on direct route, APRA to KII CHANNEL.

Answer. (*a*) and (*c*): On the direct routes to KII CHANNEL or to the north end of LUZON the line can not be formed during daylight 3 August. Three ships could reach their positions, but the

speed at which they would have to steam to do so would hardly be justified unless immediate information was required.

It seems advisable to proceed at a reduced speed and form these lines on 4 August at daylight.



SKETCH 2.
Sketch to accompany Questions and Answers on Search from Ahead.

(*b*) If the distance along the direct route to AMAMI is computed, it will be found that the scouting line can be formed normal to this course, ships at 60 miles distance, on 3 August, at about 1.25 P. M. As this permits 5 hours' search during this daylight, it is well worth while.

Question 5. What speed would be required of the scout which had the greatest distance to steam to reach its assigned position in case (*a*)?

Answer. This line is the one across direct course to north end of LUZON. The position of the southern scout by computation is latitude 15° 12′ N., longitude, 129° 59′ E.

The distance from OKINAWA to this point is 690 miles.

$$\frac{690}{45.5}=\text{about 15 knots.}$$

Question 6. Assuming case (*a*) and further instructions to "Maintain the line":

What course and speed would be used during the movement to the front on 4 August?

Answer. Course 103°.

$$\text{Speed}\ \frac{11\times 12}{13}=\frac{132}{13}=10.2\text{ knots.}$$

Question 7. At what speed would the scouts move to the rear at night?

Answer. Enemy's assumed maximum speed, 12 knots.

Question 8. If on 5 August, at 4 A. M., the commander had received radiograms from all his force reporting heavy rain, what would be the procedure at daylight?

Answer. Continue movement to the rear at 12 knots.

Question 9. If at 7.30 A. M. the commander had received reports from all scouts that the weather was again clear, one-half hour being allowed for sending and receiving radio messages, when would the scouts move to the front, and at what speed?

Answer At 8 A. M. take course 103°.

$$\text{Speed}\ \frac{(11\times 12)+30}{13-2\frac{1}{2}}=\frac{162}{10.5}=15.4\text{ knots.}$$

Question 10. If at 5 P. M. the scout commander received a radio order from the commander in chief to retire the line 50 miles by daylight, what would be the speed during the night?

Answer. Continue on course to the front until dark. Then retire

$$132+50\text{ in 11 hours}=\frac{182}{11}=16.5\text{ knots.}$$

SEARCH METHOD EXERCISE 1.

SEARCH FROM AHEAD.

Motives.—Exercise in the conduct of search operations. Study of the influence of fog on search operations.

General situation.—War exists between Orange and Blue. Blue has established an advance base at AMAMI O SIMA.

After an indecisive though severe engagement off SIMONOSEKI, the Orange fleet retired to the INLAND SEA. The Blue fleet retired to AMAMI.

On the night of second/third April, the Orange navy department learned that a Blue convoy of 10 supply ships with stores for the Blue fleet, escorted by a division of armored cruisers and a squadron of second-class cruisers, left APRA, GUAM, on the night of first/second April.

An Orange raiding force, consisting of 2 battle cruisers and a squadron of 6 second-class cruisers, at KURE, has received instructions to intercept and destroy the Blue convoy and escort.

Special situation.—On 5 April, at 5.30 A. M., the Orange second-class cruiser squadron is in the position given by, and acting in accordance with, the following extract from a campaign order:

3. (a) Scouts form line forty-five, northern ship lat. twenty-six fifty, long, one thirty-four ten, distance sixty, on five April at five-thirty A. M. commence search from ahead for enemy convoy, course one thirty-five. Maintain line. Estimated maximum speed of enemy convoy, twelve.

Required.—A sketch showing the track of each ship of this squadron from 5 April, 5.30 A. M., to 7 April, 5.30 A. M., with a note of each change of course or speed, and the reason for such change under the following assumptions:

ASSUMPTIONS GOVERNING SOLUTION.

1. Daylight, 5.30 A. M. to 6.30 P. M.
2. Maximum sustained speed of second-class cruiser squadron is 17 knots.
3. Time required to communicate by radio to all ships of the squadron is one-half hour.
4. On 5 April, 5.30 A. M., the weather is clear.
5. Clear weather continues until 6 April, 4 A. M., when all ships encounter dense fog.
6. By 6 April, 7 A. M., the squadron commander has received radio messages from all his ships stating that the fog has lifted and the weather is clear.
7. On 6 April, 12.30 P. M., the squadron commander receives the following radio:

Scouts retire at one-thirty P. M. Retire line one hundred and fifty miles by seven April, five-thirty A. M.

8. Speeds to be given to nearest tenth of a knot.

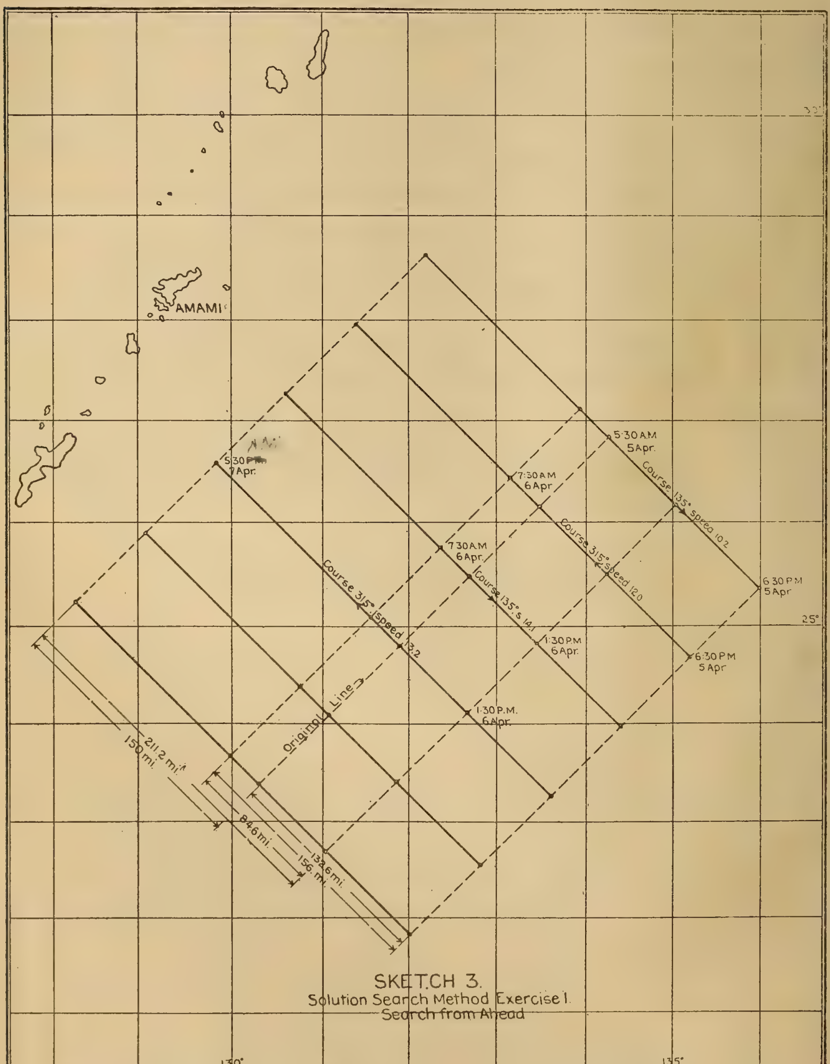
SEARCH METHOD EXERCISE 1.

SEARCH FROM AHEAD.

SOLUTION.

(Sketch 3.)

The scouting line is formed in accordance with the instructions contained in paragraph 3 (*a*) of the campaign order, at 5 April, 5.30 A. M.



SKETCH 3.
Solution Search Method Exercise 1.
Search from Ahead

The northern ship in latitude 26° 50′ north, longitude 134° 10′ east, the other ships are on a bearing 225° from the northern ship, but as the position of the northern ship was given in the order, such ship is the guide, and the other ships have brought it to bear 45°.

The scouts, which are 60 miles apart when the search is commenced, maintain this distance and line of bearing.

By 5 April, 5 A. M., the weather being clear, the squadron commander sends a radio directing the speed for the search. What should the speed be?

The instructions read "Maintain line." The speed for the search should, therefore, be such that the scouts will move to the front during daylight an amount equal to that which they will move to the rear during darkness, or 11 (hours of darkness) times 12 (enemy assumed speed in knots), which is equal to 132 miles.

This 132 miles must be covered in 13 hours of daylight; the speed will be $\frac{132}{13}=10.2$ knots.

The scouts move to the front from 5 April, 5.30 A. M., to 5 April, 6.30 P. M., at 10.2 knots=132.6 miles. The course is reversed at dark and the speed changed to that assumed as a maximum for the enemy—12 knots.

At 6 April, 4 A. M., fog is encountered, and as the fog has not lifted by daylight the speed of 12 knots on course 315° is continued.

At 7 A. M. all ships have reported clear weather, and the squadron commander directs that the course be reversed at 7.30 A. M. and the speed changed to 14.1 knots at that hour.

The speed to be used in this forward movement is obtained as follows:

The ships moved to the front 132.6 miles during daylight 5 April; the course was then reversed until 6 April, 7.30 A. M.; the retirement continued 13 hours at 12 knots (11 hours of darkness, 2 hours fog)=156 miles; the ships at 7.30 A. M. are 156−132.6=23.4 miles in rear of their original positions, and the speed must be such as to make this up during the day, or 132+23.4=155.4 miles to be steamed to the front during the remaining 11 hours of daylight $=\frac{155.4}{11}=14.1$ knots.

From 7.30 A. M. to 1.30 P. M. the speed is 14.1, the distance of $6\times14.1=84.6$ miles. 7.30

At ~~5.30~~ A. M. the ships were 23.4 miles in rear of their original line. At 1.30 P. M. they are 84.6−23.4=61.2 miles ahead of it.

The line is to be retired 150 miles by 7 April, 5.30 A. M.—that is, 150 miles from the original position, which is the reference line until changed by instructions.

The ships are 61.2 miles in advance of this original line; they must therefore move to the rear 61.2+150=211.2 miles in 5+11=16 hours. The speed will be $\frac{211.2}{16}=13.2$ knots during the movement to the rear.

CHAPTER VII.

THE SEARCH FROM THE FLANK.

CHAPTER VII.

THE SEARCH FROM THE FLANK.

The most usual form of search from the flank is the retiring search.

The retiring-search curve is the locus of successive meeting points of a scout with a force which left a known position, at a known time, at a known fixed speed, and has steamed on a steady course. It is called retiring search, because, in order to reach successive meeting points, the scout must retire; that is, must increase his distance from the enemy's point of departure at a rate equal to the assumed speed of the enemy.

In conducting a search from a flank, it is evident that a course of the scout perpendicular to successive radii from the enemy's point of departure would fulfill the condition of searching from a flank, but it is also evident that the scout would soon fall to the rear of the force for which the search is being conducted.

To prevent this falling to the rear the course of the scout must be such that the component of its course resolved along the successive radii from the enemy's point of departure, will be equal to the assumed speed of the enemy. This condition is fulfilled by the retiring-search curve.

THE SEARCH CURVE.

The object of a scout steaming on a search curve is to locate a force which left a fixed position:

(1) At an assumed time.

(2) At an assumed constant speed.

(3) On a steady course.

The assumptions in Diagram 3, page 70, are:

(a) The force A leaves point A at 6 A. M., 4 hours before scout B leaves point B. Distance AB 70 miles.

(b) The speed of force A is 10 knots and the speed of scout B is 20 knots.

(c) The scout B is to locate force A, assuming A to steer a steady course to the northward of east.

The position of B being due east of A, scout B steams west until 11 A. M., when it reaches the earliest meeting point, X.

Not finding the force A at X, B assumes that A's course lies more to the northward. The scout B now selects a new meeting point, say for 1 hour later. At that time, noon, force A will be somewhere on the position circle marked noon. The scout B can steam but 20 miles between 11 A. M. and noon. The meeting point selected should, therefore, be on the circle marked noon, 20 miles from X.

The scout B changes course at 11 A. M. to head for the new meeting point, Y.

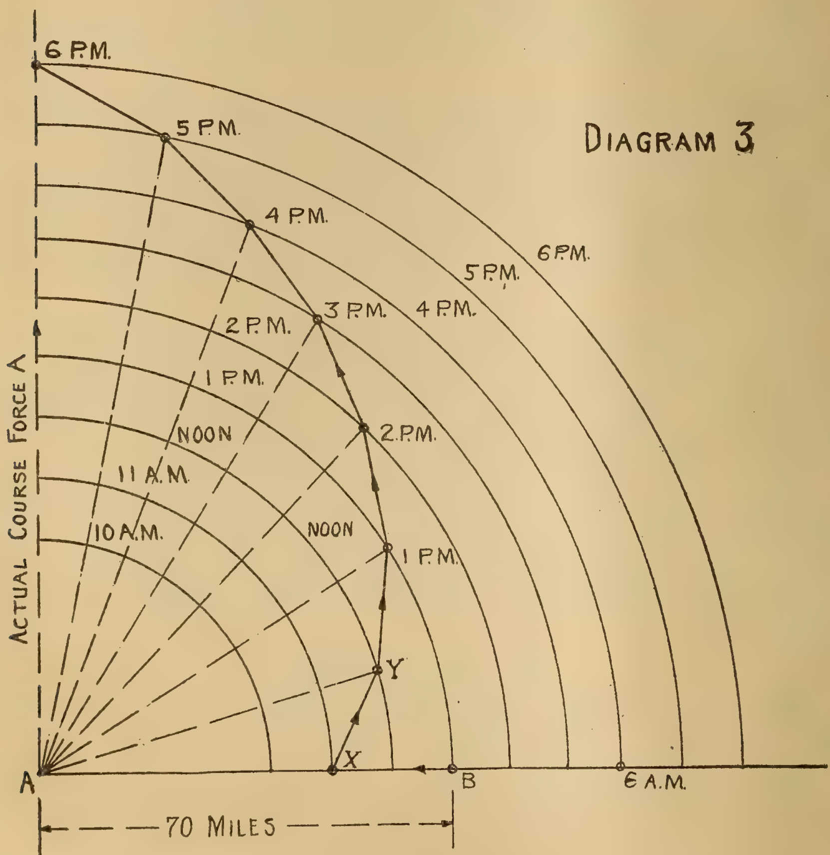


DIAGRAM 3

At noon the force A is not in sight, so the scout B again assumes a meeting point for 1 hour later, and heads for that.

Between 11 A. M. and noon, and between noon and 1 P. M., the scout B has increased its distance from point A at a rate equal to the assumed speed of force A. Successive meeting points are passed until force A is located at 6 P. M., the assumptions concerning force A having been correct.

If the time intervals between reaching successive meeting points were infinitesimal, the search curve would be a true spiral.

In practice, due to the large radius of visibility from a ship, such accuracy is not required. The course is changed three or four times during daylight, the actual path of the scout being a series of chords. The usual practice is to change course three times a day when the time from sunrise to sunset is 12 hours or less, and four times when this period is over 12 hours. The change of course at sunrise is considered a daylight change. The change of course at sunset is not considered a daylight change.

USE OF RETIRING SEARCH CURVE.

If the speed of the scout is the same as the speed of the enemy force, the search curve becomes a straight line, a radius from the point of departure, and if the enemy is not discovered at its first meeting point it will remain undetected. If the scout's speed is equal or less than the speed of the enemy force this method is useless.

Manifestly, then, a scout, to be efficient in this method of search, must have a speed materially greater than the speed of the enemy force. The higher the ratio of the speeds in favor of the scout the greater will be the curvature of the search curve and consequently the greater the number of possible enemy courses examined by the scout.

For one scout to be able to locate an enemy force by this method the enemy force must steam:

1. From a known point of departure.
2. At a known time.
3. At a known constant speed.
4. On a steady course.

A material error in any one of these assumed conditions will cause the scout to fail in its effort to locate the enemy force.

These exact conditions can not be hoped for in actual practice.

It is also necessary to modify the curve due to the reduced visibility during darkness.

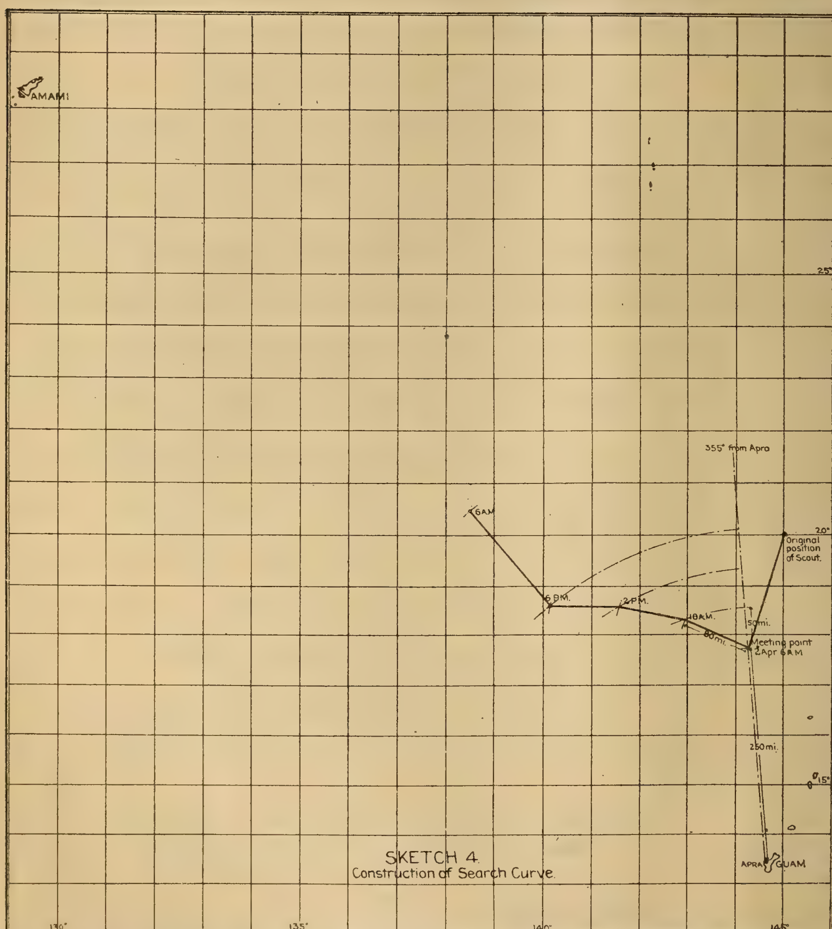
In order to show the practical application of the search curve, consider the case in which one ship is conducting a search for a force which left a known position, at a known time, at a known constant speed and on a steady course.

Example—Sketch 4.—An Orange scout in latitude 20° N., longitude 145° E., learns on 1 April, 3 P. M., that a Blue convoy left APRA, GUAM, at 10 A. M. that date. The Blue convoy's speed is assumed as 12.5 knots. The scout's speed is 20 knots.

The first calculation is to determine the earliest meeting point on a radius from the convoy's point of departure at one flank of the area in which it is desired to search. If this meeting point would be reached during dark, the speed of the scout should be reduced so as to arrive at a meeting point for daylight, on the desired radius.

As only three hours of daylight on 1 April remain, it is impossible to make contact with the convoy before daylight the next morning. The scout must adjust his course and speed to reach the selected meeting point at daylight, 6. A. M.

Night scouting, except by numerous scouts or torpedo craft in a small area, is impractical due to the reduced range of visibility.



SKETCH 4.
Construction of Search Curve.

The scout decides to search to the westward of a line bearing 355° from APRA.

The "point of origin," meeting point for daylight 2 April, 6 A. M., will be on the line bearing 355° from APRA, and distant from APRA the distance the convoy could have steamed from its time of departure 1 April, 10 A. M., until 2 April, 6 A. M., at 12.5 knots, or 250 miles.

To determine the latitude and longitude of the "point of origin," locate the enemy's position on the selected bearing from his point of departure. This may usually be done graphically on the chart. If the distance is great, it should be computed by Mercator's sailing.

The position of the "meeting point" determined graphically is latitude 17° 45′ N., longitude 144° 16′ E.

In Sketch 4, this point is marked "Meeting point, 2 April, 6 A. M."

The scout sets his course and speed to arrive at this point at 2 April, 6 A. M.

To construct the search curve: In practice the course of the scout is changed three or four times during daylight, at equal intervals, thus the track of the scout is a series of chords, which does not vary greatly from the theoretical spiral at any time, and is identical with it at the instant of each change of course. The change of course at daylight is considered a daylight change. The change at dark is not considered a daylight change. The number of courses run during daylight is, therefore, the same as the number of changes of course.

The scout being at the "meeting point" at daylight, is to run a retiring search curve to the westward. Assuming that the course of the scout is to be changed 3 times during the day and the scout is to use 20 knots speed, what should be its first course?

The position to steam for would be a new "meeting point." The "meeting point" for 10 A. M.

This point can be determined mathematically only by trial and error. As the distances are comparatively small, the position is usually determined graphically on the chart as follows:

Extend through the previously determined daylight meeting point the radius from the enemy's point of departure. Lay off on this radius, extended, the distance the enemy force would move at its assumed speed in the time interval between changes in course. In this case the time interval is 4 hours, and at 12.5 knots the enemy's assumed maximum speed, this distance would equal 50 miles.

With the enemy's "point of departure" as a center, and a radius from it to the new point (50 miles beyond the daylight position), describe an arc to the westward; this is an arc of the enemy's position circle for 10 A. M.

Now, with the "point of origin" (daylight position) as a center and a radius equal to the distance the scout will steam in four hours (in this case 80 miles), describe an arc intercepting the arc which comprises the locus of all points of the enemy's possible positions for 10 A. M., i. e., the 10 A. M. position circle. The intersection of these two arcs is the meeting point for 10 A. M.

The meeting points for 2 P. M. and for 6 P. M. are determined the same way.

At dark, 6 P. M., the scout can no longer profitably continue the search because of the reduced visibility. The scout must retire on such a course and at such speed that it will be on the enemy's position circle at daylight, and on the same radius from the enemy's point of departure as at dark.

In Sketch 5, the cross-hatched areas are the dark zones, that is, the night areas of a force which left APRA at 1 April, 10 A. M., and steamed at a constant speed of 12.5 knots on any steady course in the northwest quadrant.

The straight-dashed line from APRA to point P will be considered as the actual route of the enemy.

The scout commencing the search at C is unaware of the actual route of the enemy. He must exhaust possible routes successively by a process of elimination until the actual route is reached.

The enemy is in position J, when the scout starts its search at C.

The scout is to steam at 20 knots and to change course 3 times during daylight. Each course will be continued 4 hours, as daylight is assumed as 12 hours long.

The enemy is in position K on the dotted circle at 10 A. M., 4 hours after the commencement of the search.

At this time the scout must also be on the dotted circle; that is, he must be on the curve joining points equidistant from APRA. During this 4-hour period the scout, steaming at 20 knots, has covered 80 miles on a straight course. In order to fulfil both of these conditions the scout must be on the dotted circle 80 miles from C, which is at position D.

While steaming from C to D the scout has been increasing his distance from APRA, the enemy's point of departure, at a rate ($12\frac{1}{2}$ knots per hour) equal to the assumed speed of the enemy.

Four hours later the enemy is on the dashed circle at point L. As the scout has again increased his distance from APRA at the same rate as the enemy, he, too, is on the dashed circle at a point 80 miles from D, which is at point E.

The scout is examining possible enemy courses successively and is gradually approaching the latter's actual route.

At 6 P. M. the enemy and the scout are on the solid circle at the points M and F, respectively. The scout which was at daylight 200 miles from the enemy is at dark but 80 miles distant.

Four hours more of daylight would have permitted the scout to sight the enemy. Darkness, however, makes further search unprofitable. The scout has exhausted courses north and east of his present bearing from APRA, he therefore retires during darkness on the radius from APRA, passing through his own dark position, at a speed ($12\frac{1}{2}$ knots per hour) equal to that assumed for the enemy.

At daylight the enemy and the scout are each on the solid circle at points N and G. This point G should have been determined the same as the original "meeting point," using the bearing from APRA as a course and $44 \times 12.5 = 550$ miles as the distance.

At 10 A. M. the scout is 65 miles from the enemy and before noon he has made contact.

In this case the enemy was located because the assumptions as to its place and time of departure, and its speed, were correct, and the enemy steamed on a steady course.

In practice, seldom will all of these assumptions be exact; it is, therefore, necessary to use a group of scouts to cover the probable inaccuracies in the assumptions.

In using retiring search methods, the scouts must have a knowledge of, or assumptions as to, the enemy's—

1. Point of departure,
2. Time of departure,
3. Speed, and
4. A more or less general idea of his destination (general direction of movement).

Information of the first and second items, place and time of departure, must usually be obtained by spies, secret agents, or previous observation; the enemy's maximum speed must be estimated from a knowledge of the composition of his force; his destination or general direction of movement, from the general situation, the trend of the coast line, or other limiting conditions, such as time or steaming radius.

In practice, a group of scouts is used in order to cover inaccuracies in the enemy's assumed time of departure or in his assumed speed.

Three methods of using a group of scouts in searching from the flank have been developed. Each is based upon the retiring search curve. These methods are called:

1. The Independent Method.
2. The Sector Method.
3. The Patrol Method.

THE INDEPENDENT METHOD.

In this method a group of scouts is used, but after the search is begun each scout acts independently of every other scout. Because of the independent action of each scout, this is called the independent method.

The enemy's point of departure is known or assumed. If the information is indefinite, either the enemy's time of departure or enemy speed is assumed the same by all scouts, and the other, time of departure or speed, varied by a uniform amount, each scout searching on a different assumption.

HOW TO START THE SEARCH.

Each scout must start the search at a meeting point, under the assumed conditions of enemy time of departure and speed for which the scout is to search.

As in searching from the flank, the search must be begun on one flank of the area to be searched, the group of scouts usually starts the search on a radius from the enemy's assumed, or known, point of departure. The scout, at the greatest distance from the enemy's point of departure at a meeting point, assuming the earliest time of departure and enemy's assumed maximum speed; the other scouts spaced equally at meeting points for other assumptions.

The scouts should be on one flank of the area to be searched and the search curves run toward the other flank.

When the enemy's speed and time of departure are known, the scouts may be placed along the position circle rather than along a radius. Sometimes a combination of these methods is used.

WHERE AND WHEN TO START THE SEARCH.

The position in which the search is to be started and the time at which the search is to begin are dependent on many conditions, the principal ones being:

1. Time available for taking position. This may limit the possible positions that can be reached.
2. The area in which the enemy may lie at the time the search can be commenced.
3. The desired general direction of movement of the scouts, to effect concentration, or to coordinate with other groups.
4. The enemy's probable destination.
5. Whether or not the earliest meeting point on the desired radius can be reached in daylight.

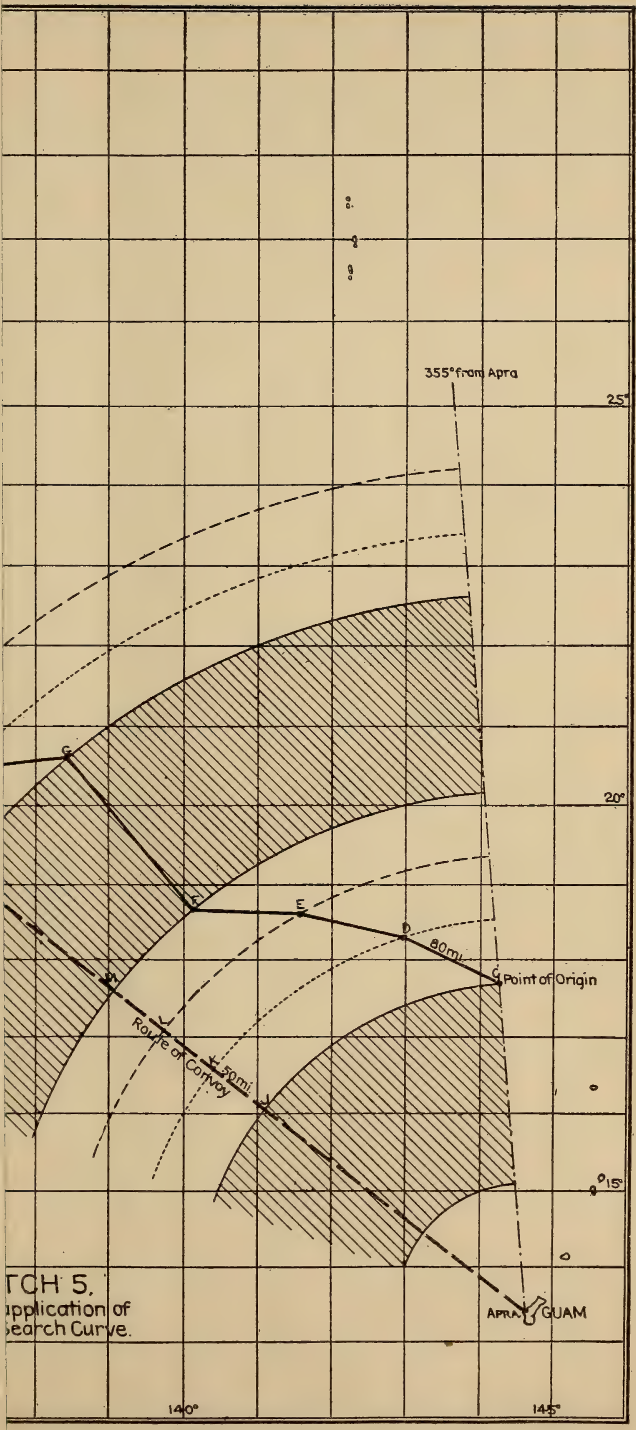
CASE I.

DIFFERENCE IN ASSUMED HOUR OF DEPARTURE, SAME ASSUMED SPEED.

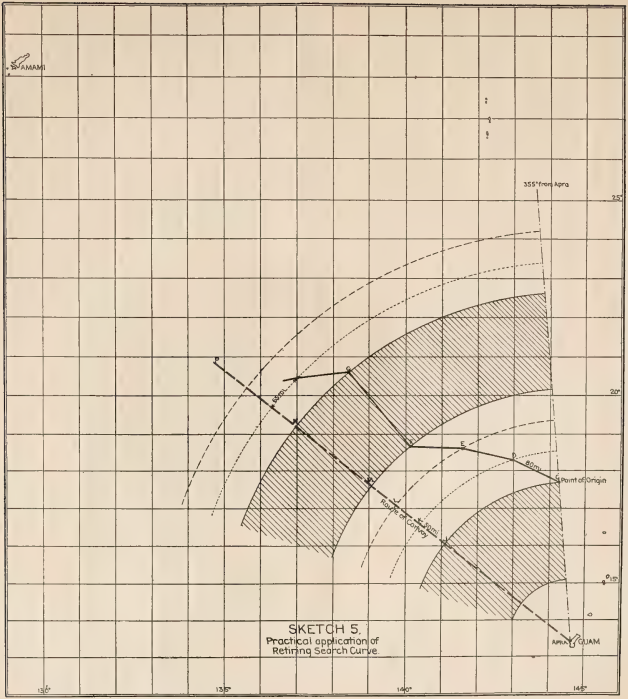
Sketch 6 shows the use of 4 scouts to search by the independent method for an enemy force which sailed from APRA 1 August at some time between 10 A. M. and 4 P. M.

The scout, which is to occupy the position most distant from APRA, determines a meeting point for 2 August, 6 A. M. (daylight), assuming enemy's earliest time of departure 10 A. M. and enemy's maximum speed $12\frac{1}{2}$ knots, the meeting point to be on a line bearing 355° from APRA.

The next scout from the northward is, at daylight, on this same bearing, 355° from APRA, and at a meeting point, on the assumption



TCH 5.
ipplication of
Search Curve.



SKETCH 5.
Practical application of
Retiring Search Curve.

that the enemy left APRA on 1 August, noon, and steamed at his maximum speed, 12½ knots.

These positions are on the same radius from APRA and 25 miles apart, 25 miles being the distance the enemy would steam in 2 hours at 12½ knots, 2 hours being the variation in the assumed times of enemy departure.

The third and fourth scouts are on the same radius; the third 25 miles nearer the enemy's point of departure than the second, and the fourth 25 miles nearer than the third.

At daylight each of these scouts starts a retiring search to the westward. Each scout steams at 20 knots, and as the enemy's assumed speed in each case is 12½ knots, the curves are nearly parallel; such difference as exists is due to the difference in the distance of the scouts from the enemy's point of departure.

As can be seen in Sketch 6, the difference in the distance of the scouts from the point of departure causes a dispersion of the scouts as the search progresses.

At 6 P. M. the 2 southern scouts are separated by 38 miles. Their distance has increased from 25 to 38 miles during one day's run.

At dark each scout retires on a radius from APRA, passing through its own dark position, at the enemy's assumed speed, 12½ knots an hour.

A greater dispersion is caused by this retirement, for the distance between the radii from the enemy's point of departure increases as the radii increase in length. The positions for daylight 3 August are shown in the sketch. The distance between the southern scouts is now 45 miles. By dark of the second day this method will have become inefficient for covering all the area in which the enemy might lie, assuming the enemy's hour of departure between 10 A. M. and 4 P. M., due to the dispersion of the scouts. It continues efficient for assumptions close to those upon which each scout is basing its search.

CASE II.

DIFFERENCE IN ASSUMED ENEMY SPEED—SAME ASSUMED HOUR OF DEPARTURE.

Sketch 7 shows the method using 4 scouts to search by the independent method, for an enemy force which sailed from APRA, 2 August, 10 A. M. Enemy's speeds assumed as from 12½ to 8¾ knots. Variation in speed assumed for enemy by adjacent scouts (12½–8¾)÷3=1¼ knots.

The scout, which is to occupy the position most distant from APRA, determines a meeting point for ~~2~~ August, 6 A. M. (daylight), assuming enemy's speed 12½ knots, time of enemy's departure 2 August, 10 A. M., the meeting point to be on a line bearing 355° from APRA.

The next scout from the northward at daylight is on the same bearing, 355° from APRA, and at a meeting point on the assumption that the enemy left APRA 2 August, 10 A. M., speed $11\frac{1}{4}$ knots.

These positions are on the same radius from APRA and 25 miles apart, 25 miles being the difference between the distances the enemy would steam at $12\frac{1}{2}$ and at $11\frac{1}{4}$ knots in a period of 20 hours, the time elapsed between time of enemy's departure and the time the line is formed.

The third and fourth scouts are on the same radius; the third, assuming the enemy's speed as 10 knots, is 25 miles nearer the enemy's point of departure than the second; and the fourth, assuming enemy's speed at $8\frac{3}{4}$ knots, is 25 miles nearer than the third.

At daylight each of these scouts starts a retiring search to the westward. Each scout steams at 20 knots.

As the assumed enemy speeds are materially different, there is a rapid dispersion of the scouts. At dark this distance is about 55 miles.

Each scout retires during darkness on the radius from the enemy's point of departure, passing through its own dark position, at the speed it has assumed for the enemy.

This retirement on different radii at different speeds causes a still wider dispersion of the scouts, and at daylight the scouts are 80 miles apart.

The scouts being more than 60 miles apart, there is a chance that the enemy force may pass between adjacent scouts unobserved. The efficiency of the search is reduced for possible speeds, but remains efficient for each of the assumed speeds.

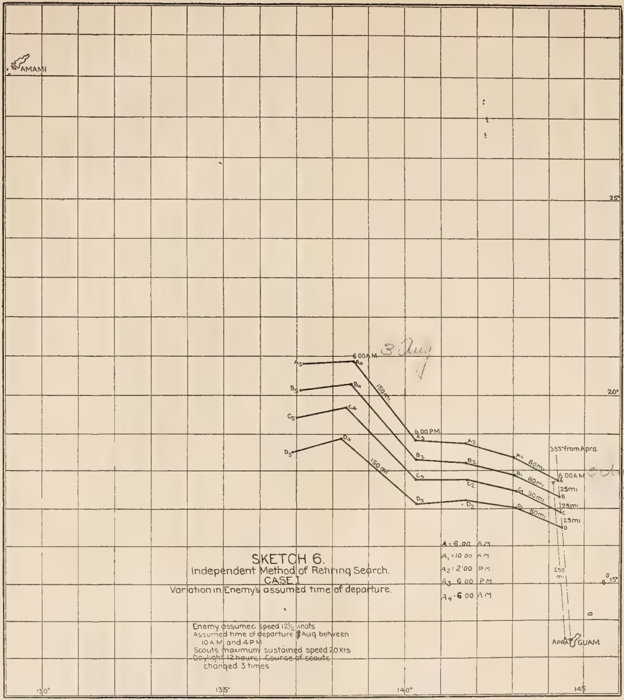
The examples show that the independent method is not suitable for coordinated movements of a group of scouts for more than one day, due to the increased dispersion of the scouts. It is generally used when the number of scouts is very small compared to the area to be covered. Probable enemy speeds are assumed, and the search conducted independently in the hope that one of the scouts may have assumed a speed near to the actual speed of the enemy.

In case of fog or other unfavorable visibility conditions, each scout acts independently, moving away on the radius from the enemy's point of departure during such unfavorable conditions, at the speed assumed for the enemy.

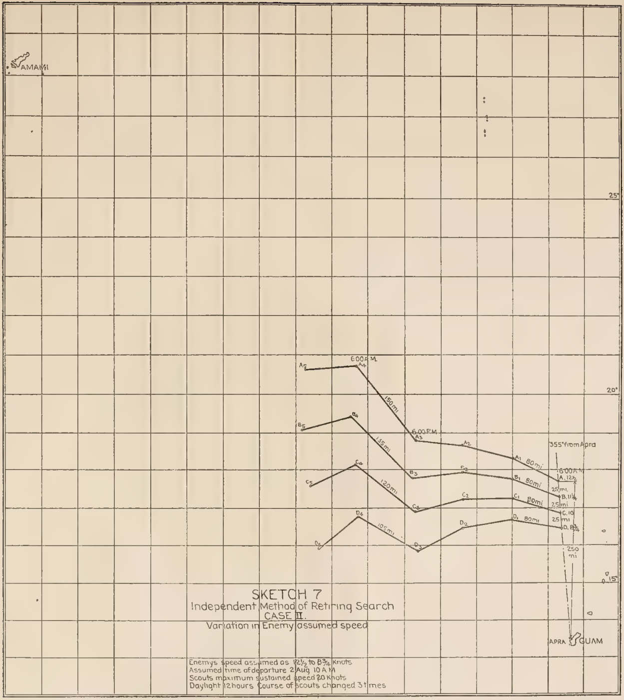
RETIRING DURING THE NIGHT.

In all forms of retiring search, a modification of the above-described direction of retirement is sometimes used as follows:

When the enemy's destination is known or assumed, the retirement of the line during dark is made along the radius from the enemy's



SKETCH 6.
Independent Method of Retiring Search.
CASE I
Variation in Enemy's assumed time of departure.



AMAMI
25°
20°
15°
6.00 A.M.
A_5 A_4
150 mi
6.00 P.M.
A_3 A_2 A_1
80 mi
355° from Apra
6.00 A.M.
A. 12½
B_5 B_4
135 mi
B_3 B_2 B_1
80 mi
25 mi.
B. 11¼
C_5 C_4
120 mi
C_3 C_2 C_1
80 mi
25 mi
C. 10
D_5 D_4
105 mi
D_3 D_2 D_1
80 mi
25 mi
D. 8¾
250 mi
APRA
GUAM
SKETCH 7
Independent Method of Retiring Search
CASE II.
Variation in Enemy assumed speed
Enemys speed assumed as 12½ to 8¾ Knots
Assumed time of departure 2 Aug 10 A M
Scouts maximum sustained speed 20 Knots
Daylight 12 hours Course of scouts changed 3 times

point of departure until the scouts are nearer to the enemy's assumed destination than they are to the point of departure. When nearer to the enemy's assumed destination than to the enemy's point of departure, the retirement is usually made in the general direction of the enemy's assumed destination. In making this retirement, however, the course and speed must be such as to increase the distance from the enemy's point of departure at the enemy's assumed speed.

The reason for these forms of retirement is, until the enemy has moved half the distance to his destination, his course probably is direct from his point of departure; after more than half the distance is covered, the probabilities are that the enemy will be heading for his destination, and in this case, if the course of the scouts was continued along the radius from the point of departure, the enemy might pass through the line of scouts, during the night, unobserved.

ADVANTAGES OF INDEPENDENT METHOD.

The independent method of retiring search has the following advantages:

1. Makes the best use of a small number of fast scouts.
2. Permits each scout to make use of its maximum sustained speed.
3. Is least affected by unfavorable weather conditions over a portion of the force.

It has the following disadvantages:

1. Wide dispersion of scouting force.
2. Speed of scouts must be materially greater than speed of enemy.
3. Requires large fuel consumption.
4. Scouts must start from a flank.
5. Search must begin soon after enemy's departure, if a large area is to be covered.
6. The assumptions as to the enemy's speed and time of departure must be close to the actual for it to be effective.

CHAPTER VIII.

EXAMPLES OF SEARCH FROM THE FLANK. INDEPENDENT METHOD.

CHAPTER VIII.

QUESTIONS AND ANSWERS—SEARCH FROM THE FLANK.

INDEPENDENT METHOD.

(Sketch 8.)

Question 1. Why is the "Retiring search" so called?

Answer. The locus of successive meeting points, the retiring search curve, is so called because, in order to reach these successive meeting points, the scout must retire, that is, must increase his distance from the enemy's point of departure at a rate equal to the speed of the enemy force.

Question 2. What is meant by the "Independent method"?

Answer. The Independent Method is a method of using a group of scouts in the retiring search, in which each scout is given certain assumptions with regard to the enemy's point of departure, time of departure, speed, and general direction of movement, and conducts the search on these assumptions independently of the operations of any other scout.

Question 3. Compute the earliest meeting point for two ships which leave port simultaneously, as follows:

(*a*) From POLILLO at 20 knots.

(*b*) From COFFIN BAY at 10 knots.

Answer. Distance COFFIN BAY to POLILLO: Mercator's sailing:

COFFIN BAY,	Lat. 26° 35′ N.	POLILLO,	Lat. 14° 50′ N.
	Long. 142° 10′ E.		Long. 122° 10′ E.

$Lat._1$ 26° 35′ N.	Merid. parts, 1,645.0	$Long._1$ 142° 10′ E.
$Lat._2$ 14° 50′ N.	Merid. parts, 894.1	$Long._2$ 122° 10′ E.
11° 45′ N.	M. 750.9	D. Lo.=20° 00′ W.
705′		1,200′ W.

D. Lo.=1,200	log. 3.07918	
M.=750.9	log. 2.87558	
C.=237° 58′	log. tan. .20360	
D. L.=705′		log. 2.84819
Dist.=1,330 miles		log. 3.12362

Ships leave COFFIN BAY and POLILLO simultaneously.

They approach each other at 30 knots.

They will meet $\frac{1,330}{30}=44\frac{1}{3}$ hours.

20-knot scout will have steamed $886\frac{2}{3}$ miles from POLILLO.

10-knot ship will have steamed $443\frac{1}{3}$ miles from COFFIN BAY.

Course 238°, distance $443\frac{1}{3}$.

D. L.	= 234.9 S.			
$L._1$	= 26° 35′ N.			
D. L.	= 3° 55′ S. Dep. = 376	D. L. 24° = 411.6		
		25° = 414.9		
$L._2$	= 22° 40′ N.	3) 3.3		
		1.1		
Mid. L. = 24° 40′		2		
		2.2	Long. =	142° 10′ E.
		411.6	D. L. =	6° 54′ W.
		D. L. 24° 40′ = 413.8	$L._2$ =	135° 16′ E.

Meeting point:

Lat. 22° 40′ N.

Lon. 135° 16′ E.

Question 4. A Blue force leaves APRA, GUAM, on 31 March at noon. Estimated speed $12\frac{1}{2}$ knots. An Orange scout, maximum speed 20 knots, at COFFIN BAY learns of the departure of this Blue force and decides to search to westward from direct course APRA—KII CHANNEL, using the retiring search. Scouting speed 20 knots. Time of scout's departure 1 April, 10 A. M. Daylight 6 A. M. to 6 P. M.

Answer. The Orange scout finds it impossible to reach a meeting point during daylight 1 April, so decides to start the search 2 April at daylight.

The meeting point is determined as follows:

Blue left APRA on 31 March at noon.

Search is to commence 2 April at 6 A. M.

Time elapsed since Blue's departure=42 hours. 525

In 42 hours Blue, at $12\frac{1}{2}$ knots, could steam ~~540~~ miles.

Course from APRA to KII CHANNEL is approximately 336°.

APRA=latitude 13° 25′ north, longitude 144° 35′ east.

From Table 2, Bowditch: D. L.=498.8=8° 19′.

Latitude of meeting point 13° 25′+8° 19′=21° 44′ N.

As the point must be on course APRA—KII CHANNEL, it is not necessary to determine the longitude.

Describe arcs to the westward using radii increased by increments of 50 miles ($4\times12\frac{1}{2}$). These are arcs of Blue's position circles at 10 A. M., 2 P. M., and 6 P. M.

With the daylight meeting point, point of origin, as a center and a radius of 80 miles (4×20), the distance the scout steams between 6 A. M. and 10 A. M., describe an arc intersecting the Blue 10 A. M. position circle. This is the meeting point for which the scout sets his course at 6 A. M.

Meeting points are similarly determined for 2 P. M. and 6 P. M., using as a center for the small arc, the last determined meeting point.

The line joining these successive meeting points is the retiring search curve to be followed by the scout.

Question 5. An Orange force of 4 scouts at COFFIN BAY is informed of the above-mentioned movement of the Blue force and is ready to sail 1 April at 10 A. M. Maximum sustained speed, 20 knots. Daylight 6 A. M. to 6 P. M.

When and where should each scout start the search under the following instructions:

Search for Blue force to westward of line bearing north from APRA. Independent search. Assume enemy speeds 13 to 10 knots?

Answer. APRA, latitude=13° 25′ N. Blue has steamed 42 hours at 13=546 miles.

D. L.=9 06

Latitude of point of origin=22° 31′ N.

Assumed speeds 13–10, spaces 3=difference 1 knot.

42 hours $\times$ 1 knot=42 miles apart.

Question 6. What would be the difference in the positions of the scouts when starting the search, if the information of the sailing of this Blue force had been "Sailed 31 March, between 10 A. M. and 4 P. M. Speed, 13 knots," and the instructions had read:

Search for Blue force to westward of line bearing north from APRA. Independent search. Assume variations of two hours in time of enemy's departure.

Answer. If Blue sailed 31 March at 10 A. M., the meeting point would be $44 \times 13 = 572$ miles from APRA. This gives the position of the scout most distant from APRA.

Difference in time of departure 2 hours at 13 knots=26 miles. The scouts would be, on 2 April, at daylight, 26 miles apart.

Question 7. Assuming a Blue force, assumed speed 13 knots, left APRA on 31 March at 10 A. M., at what time and in what position could a scout of 19 knots sustained speed start a search for this Blue force, the scout leaving POLILLO 1 April, 6 P. M., and to search to the northward from the direct route APRA—POLILLO by retiring search?

Answer. APRA, Lat. 13° 25′ N. Long. 144° 35′ E. POLILLO, Lat. 14° 50′ N. Long. 122° 10′ E.

$L._1$ =13° 25′ N.	Merid. parts=807.0	$Long._1$ = 144° 35′ E.
$L._2$ =14° 50′ N.	Merid. parts=894.1	$Long._2$ = 122° 10′ E.
D. L. = 1° 25′ } N.	m.= 87.1	D. Lo. = 22° 25′ W.
85′ }		1345′ W.

D. Lo.=1345′ log. 3.12872
m.= 87.1 log. 1.94002
log. tan. 1.18870 log. sec. 1.18961
D. L.=85 -- log. 1,92942

Dist.=1315 -- log. 3.11903

Blue leaves APRA 31 March, 10 A. M., speed 13 knots.

Scout leaves POLILLO 1 April, 6 P. M., speed 19 knots.

Blue has steamed 32 hours at 13 knots when the scout starts. 32×13=416 miles.

The scout and Blue force are 1,315—416=899 miles apart.

They approach at 13+19=32 knots per hour.

They will meet in $\frac{899}{32}$=28 hours 5 minutes from 1 April, 6 P. M.

This would be during darkness, so the scout would slow to meet Blue on 3 April at daylight.

To 6 A. M. 3 April, Blue has made 68×13=884 miles from APRA.

The meeting point is in longitude 129° 25′ E.

Question 8. Draw the search curve for 24 hours after the search begins.

Answer. The search curve is constructed as previously described. The scout retires along the radius from APRA at 13 knots during darkness. The curve is shown in Sketch 8.

Question 9. What would be the difference in time of starting the search and in the position of the "point of origin" if the scout's maximum sustained speed had been 25 knots?

Answer. If the scout could make 25 knots the scout and Blue force would meet in $\frac{899}{38}$ hours after the scout's departure, or at 23 hours 40 minutes after departure. This would permit but 20 minutes of search during this daylight and would not be worth while.

The scout would therefore start searching at 3 April, daylight, in the same position in which the 19-knot scout would start.

The search curve is constructed as has been explained.

The curve is shown in Sketch 8.

Question 10. What is the difference in angular measure, from the enemy's point of departure, of the area covered by the scout of 19 knots' speed and the scout of 25 knots' speed in 24 hours of search?

Answer. The arc covered by the 19-knot scout subtends an angle of 9°.

The arc covered by the 25-knot scout subtends an angle of $14\frac{1}{4}$°.

An increase in scouting speed of 6 knots, less than $33\frac{1}{3}$ per cent, has increased the angle covered about 58 per cent.

SEARCH METHOD EXERCISE 2.

SEARCH FROM THE FLANK—INDEPENDENT METHOD.

(Sketch 9.)

Motives.—Exercise in the conduct of search operations. Independent method.

Study of the influence of fog on search operations.

General situation.—War exists between Orange and Blue. Blue has established an advance base at AMAMI O SIMA. After an indecisive though severe engagement off SIMONOSEKI the Orange fleet retired into the INLAND SEA. The Blue fleet retired to AMAMI.

On 30 March, noon, the commander of an Orange raiding force based at PORT LLOYD, BONIN ISLANDS, learned that a Blue convoy of 10 supply ships with stores for the Blue fleet left APRA, GUAM, on 30 March about 5.30 A. M., escorted by a division of armored cruisers and a squadron of second-class cruisers.

The commander of the Orange raiding force, consisting of 2 battle cruisers and 4 second-class cruisers, based at PORT LLOYD, BONIN ISLANDS, decided to intercept and destroy the Blue convoy and escort.

Special situation.—On 1 April, 5.30 A. M., the Orange second-class cruiser division, under command of Rear Admiral OQ., is in the position indicated by and acting under the following orders [extract from campaign order No. 2]:

3. (a) Scouts search westward from line bearing zero degrees from APRA. Independent method. Scouting speed twenty. Scouts assume enemy convoy speed as follows: F–1, eleven; F–2, ten and one-half; F–3, ten; F–4, nine and one-half. Assume enemy departure thirty March, five-thirty A. M. Start search one April, five-thirty A. M.

Required.—A sketch showing the track of each ship of the division from 1 April, 5.30 A. M., to 3 April, 5.30 A. M., with a note of each change of course and speed, and reason for change, under the following assumptions:

ASSUMPTIONS GOVERNING SOLUTION.

1. Daylight, 5.30 A. M. to 6.30 P. M.
2. Maximum sustained speed of second-class cruisers is 20 knots.
3. In running independent search, course is to be changed four times during daylight.

4. During 1 April the weather is fair and clear.

5. On 2 April, at 5.30 A. M., the two northern ships are in a dense fog. All other ships have clear weather.

6. On 2 April, at 8.45 A. M., the fog over the two northern ships lifts and the weather is clear.

7. On 2 April, at 5.30 P. M., the squadron commander receives the following radio message:

From BB–1:

No further news of enemy. Battle cruisers in lat. twenty-seven, long. one thirty-six; course two seventy; speed twelve. Will retire on two April, six-thirty P. M. toward AMAMI.

Scouts retire toward AMAMI during night second/third, April. Continue search on three April, by present method.

[S] ON,
Vice Admiral.

SEARCH METHOD EXERCISE 2.

SEARCH FROM THE FLANK—INDEPENDENT METHOD.

SOLUTION.

(Sketch 9.)

The scouts take positions 1 April at 5.30 A. M. on a line bearing zero degrees from APRA.

The time elapsed since the enemy's departure is 48 hours.

F–1 would be $48 \times 11 = 528$ miles from APRA.

F–2 would be $48 \times 10.5 = 504$ miles from APRA.

F–3 would be $48 \times 10 = 480$ miles from APRA.

F–4 would be $48 \times 9.5 = 456$ miles from APRA.

On account of the confusion of points if only one radius was used, additional radii from APRA are drawn for the purpose of aiding the construction of the search curves.

On 1 April, at 5.30 A. M., each scout starts a retiring search curve to the westward. The course is to be changed at intervals of $3^h\ 15^m = 3.25$ hours. The increase in radius for each period is, for—

F–1, $11 \times 3.25 = 35.75$ miles.

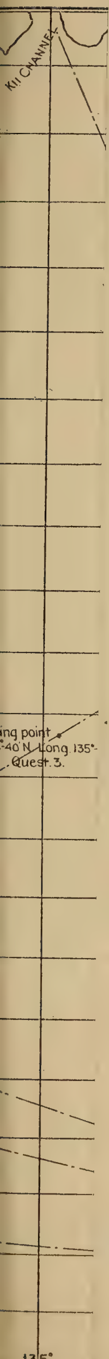
F–2, $10.5 \times 3.25 = 34.1$ miles.

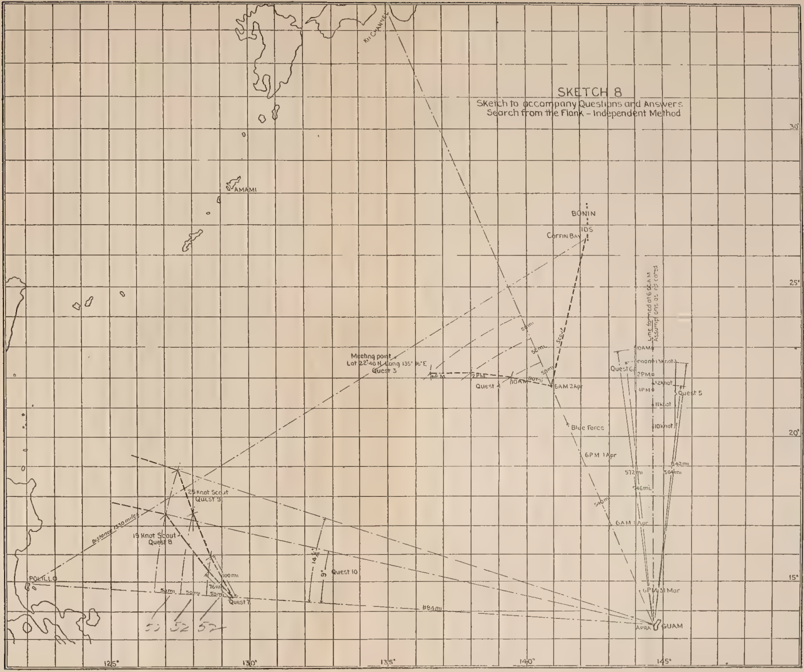
F–3, $10 \times 3.25 = 32.5$ miles.

F–4, $9.5 \times 3.25 = 30.9$ miles.

Each scout steams at 20 knots during favorable weather conditions. The distance steamed in each period is, therefore, $20 \times 3.25 = 65$ miles.

The search curves are constructed for each ship separately. Use *F–1* as an example. The original position is on a line bearing zero degrees from APRA, and 528 miles from APRA. Plot this point.


KII CHANNEL
ing point
-40'N. Long. 135°-
Quest. 3.
135°


SKETCH 8
Sketch to accompany Questions and Answers
Search from the Flank - Independent Method
KII CHANNEL
AMAMI
BONIN
IDS
COFFIN BAY
Meeting point
Lat 22°40 N Long 135° 16' E
Quest 3
Quest 4
6AM 2Apr
Scout
Blue Force
6PM 1Apr
6AM 1Apr
6PM 31 Mar
Quest 5
Quest 6
Line formed at 6 AM
Assumptions as regard
25 Knot Scout
Quest 9
19 Knot Scout
Quest 8
Distance 1330 miles
POLILLO
Quest 7
Quest 10
884mi
APRA
GUAM
30°
25°
20°
15°
125°
130°
135°
140°
145°

Now swing an arc with APRA as a center and a radius equal to 528 plus the increase in distance for the assumed speed of convoy for a period of 3.25 hours, or 528+35.8=563.8 miles. With the original position as a center and a radius of 65 miles, the distance the scout steams in 3.25 hours at 20 knots, strike an arc intercepting the arc drawn with the large radius. This is the point at which *F–1* should arrive at 8.45 A. M., and the course is set for this point. Successive points are located similarly except that in each case the center of the arc of 65 miles radius is the position occupied at the end of the preceding interval.

On 1 April, at 6.30 P. M., each ship retires on a radius from APRA, passing through its own position, at the speed assumed for the enemy.

F–1 retires during the night, 11.0×11=121 miles.

F–2 retires during the night, 10.5×11=115.5 miles.

F–3 retires during the night, 10.0×11=110 miles.

F–4 retires during the night, 9.5×11=104.5 miles.

At 5.30 A. M. the 2 northern ships are in fog, and must continue on the radius from APRA at the enemy's assumed speed; they continue along this radius until 8.45 A. M. when it is again clear. The search curves are then started as upon the day previous.

F–3 and *F–4*, which scouts encountered no fog, started the search curves at daylight.

On 2 April the scouts are given instructions to retire at 6.30 P. M. toward AMAMI, and to continue present method of search on 3 April.

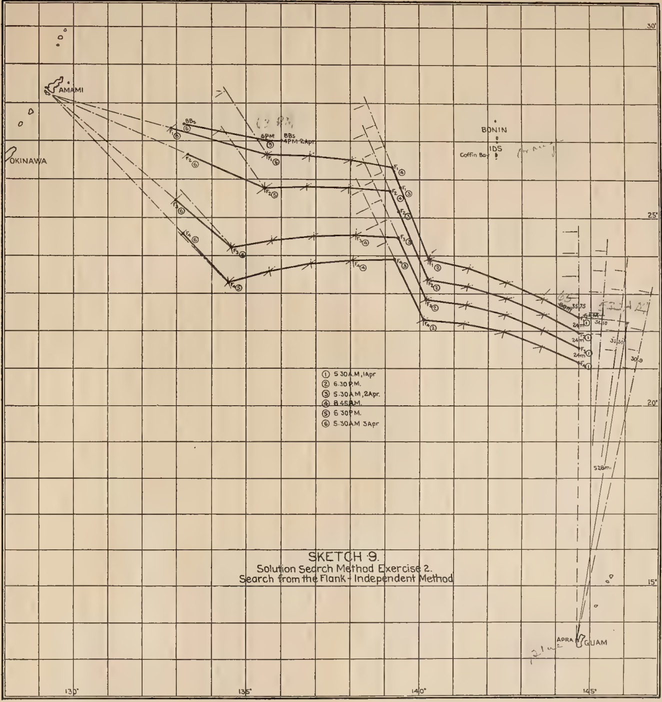
Such an order has two motives.

First, when nearing the destination the convoy is most probably heading for its destination, and so the movement of the scouts should be in that general direction rather than on the radius from the point of departure.

Second, it concentrates the scouting force and, if the enemy has been passed during the night by the high speed used, the scouting force is ahead of it. As the area is restricted near the destination, a new method may be adopted if desired.

If the method is to be continued the course of each scout should be changed to head toward AMAMI at dark 2 April. The speed should be adjusted so that at daylight 3 April each scout is on the proper position circle to begin his search; that is, each scout's distance from Apra should be equal to the hours since departure of Blue convoy multiplied by convoy's assumed speed; for *F–1* this would be 1,056 miles.

If it should be found that, when steaming for the enemy's assumed destination during the night, the scout has insufficient speed to reach the proper daylight circle the course should be so modified as to permit the proper daylight circle to be reached.



SKETCH 9.
Solution Search Method Exercise 2.
Search from the Flank - Independent Method

CHAPTER IX.

THE SEARCH FROM THE FLANK (CONTINUED)—SECTOR METHOD.

CHAPTER IX.

SEARCH FROM THE FLANK—Continued.

SECTOR METHOD.

Sector Methods of Using the Retiring Search.

GENERAL.

In the discussion of the Independent Method of retiring search, it was seen that a wide dispersion of the scouts was caused by using a variation in the assumed time of the enemy's departure, Case I, or variation in the assumed enemy speed, Case II.

The conclusion that the independent method was not suitable for the use of several scouts which are coordinating their movements to cover an area, led to the development of a method of using the retiring search with a group of scouts, that maintains the greatest concentration of the searching force while covering the assumed variation in enemy speed, or assumed variation in enemy time of departure.

The avoidable dispersion of the scouts, when all scouts are using the same speed, in the independent method, is due to the greater angle covered by a scout nearer to the enemy's point of departure.

The difference in angular velocity of the scouts causes dispersion during the day, and at night, although there is no angular change by any scout, the dispersion increases because of the difference in the courses of the scouts, each retiring along a radius from the enemy's point of departure passing through its own dark position.

The simplest way to avoid this dispersion is to cause all scouts to steam at such speeds that the angular velocity of each would be the same. To do this it is necessary to limit the sector covered by each scout to that which can be covered at maximum sustained speed by the least effective scout. This would be the scout which is searching on the assumption of earliest enemy time of departure, or highest assumed enemy speed, if the scouts are homogeneous. If not homogeneous the guide will be the scout which at its maximum speed covers the least angle.

The scouts start the search on a given radius from the enemy's point of departure. Each runs a retiring search curve at such scouting speed that they maintain the scouting line on a slowly

changing line of bearing, the line of bearing at any time being the radius from the enemy's point of departure passing through the guide.

As during any period of time the scouts are limited to a certain sector between radii from the enemy's point of departure, this method is called the "Sector method."

CASE I.

(Sketch 10.)

SECTOR METHOD TO COVER VARIATIONS IN ASSUMED ENEMY SPEEDS.

The scouts of the group are assumed to be homogeneous. They are directed to use the sector method and to cover certain given enemy speeds. The scout which is to steam at its maximum sustained speed is directed to run a retiring search, assuming the maximum enemy speed; the other scouts assume enemy speeds varying equally down to the assumed enemy minimum speed.

FORMING THE LINE.

The line is formed on a radius from the enemy's point of departure, on one flank of the area to be searched; each scout at a meeting point in accordance with its assumptions regarding the enemy's time of departure and speed.

As the scouts will be equally spaced on the line, their position is most readily found by determining the meeting point for one, and placing the others at the proper distance apart on the radius from the enemy's point of departure.

This distance between scouts will be xy, where x=the difference in assumed enemy speeds used by adjacent scouts, and y=hours elapsed since enemy's departure.

Example (*Sketch 10*).—A group of 4 homogeneous scouts is to form on 2 August at daylight for the use of the sector method, 24 hours after the departure of an enemy force from APRA, the assumed speeds of which enemy force are from 12 to 9 knots. Daylight, 6 A. M. to 6. P. M.

The scouts assume enemy speeds, 12, 11, 10, 9 knots. The most distant scout would be 12×24=288 miles from the point of departure when the line is formed. The adjacent scout xy miles nearer the point of departure, x=1, y=24, xy=24 miles.

CONDUCT OF THE SEARCH.

The scouts all use the same time of enemy departure, but each uses a different assumed enemy speed. Each scout, while running the search, increases its distance from the enemy's point of departure at

a different rate. The distance between scouts is therefore constantly increasing. All scouts use such course and speed as to make their angular velocity the same. They thus maintain their line on a slowly changing line of bearing, the line of bearing at any time being a radius from the enemy's point of departure.

In the discussion of the retiring search it was seen that in practice the true spiral of the retiring search is approached by a series of chords. The same procedure is followed here.

The scout, which assumes the condition of enemy's maximum speed, runs a retiring search. The angular distance that such scout can cover is the sector within which the search is to be confined. In the scouting order this sector is given, or else the speed of the scout on the outer arc is given, and the sector determined by each scout.

The course is changed three or four times during daylight at equal periods of time. The practice in this respect should be a matter for instructions, and should be constant.

Scouts, other than the one on the outer arc, so direct their course and speed as to be, at the time of each change of course, on the same radius from the enemy's point of departure as is the guide, usually the scout on the outer arc, and at distances apart equal to xy. This distance varies with y, which is equal to the number of hours since the enemy's departure.

In practice, the positions for interior scouts is determined by drawing the search curve for the outer scout, connecting the points at which the course is to be changed with the enemy's point of departure, and laying off on this line the distances xy in each case.

The course and speed of interior scouts must be such as to reach their successive points thus determined.

This form of search maintains the greatest concentration of the scouts consistent with covering the assumed enemy speeds. It is efficient for all speeds between the assumed maximum and minimum, so long as the distance xy does not exceed twice the range of visibility of the force for which the search is being conducted. It does not cover as great a sector for low enemy-assumed speeds as does the independent method.

The scouts on the inner arcs steam at speeds below their maximum if the group is homogeneous. In using this method it is possible to maintain the concentration of a nonhomogeneous force by placing the faster ships on the outer arcs and the slowest ship nearest to the enemy's point of departure. If the slowest ship searching the lowest assumed enemy speed can not cover as much arc as the faster ships on exterior curves, the slowest ship must be made the guide.

In this sketch is also shown the method of retirement toward the enemy's assumed destination, in this case AMAMI.

The scout A, the guide, retires on a course direct for AMAMI, not at the enemy's assumed speed, but at a speed such that he will be at daylight on the enemy's 12-knot position circle for that time.

The distance from position A_7 to X is the distance the enemy would move during dark. As the scout moves on the direct course to AMAMI he steams A_7 to A_8, which is greater than A_7 to X. The points X and A_8 are each on the enemy's position circle for the speed assumed.

Scouts B, C, D, take positions at daylight at the intersection of the enemy position circles for their respective assumed enemy speeds, and the radius A_8 to the enemy's point of departure.

The search is continued from this radius in a manner similar to the search on the day previous. The scouts are at this time too far apart (72 miles) for the search to be efficient for all enemy speeds between the maximum and minimum.

CASE II.

(Sketch 11.)

SECTOR METHOD TO COVER VARIATION IN ENEMY TIME OF DEPARTURE.

FORMING THE LINE.

When a fixed speed is assumed for the enemy, and a variation in the hour of departure assumed, the scouts form on a radius from enemy's point of departure at distances equal to, the difference in hours between enemy's earliest and latest times of departure, multiplied by the assumed enemy speed and divided by the number of spaces between scouts.

Example (*Sketch 11*).—Line to be formed at daylight, 6 A. M., 2 August.

Assumed enemy speed, $12\frac{1}{2}$ knots.

Assumed time of departure, between 10 A. M. and 4 P. M., of the previous day.

Number of scouts, 4; number of spaces, 3.

$$\text{Distance} = \frac{12\frac{1}{2} \times 6}{3} = \frac{75}{3} = 25 \text{ miles.}$$

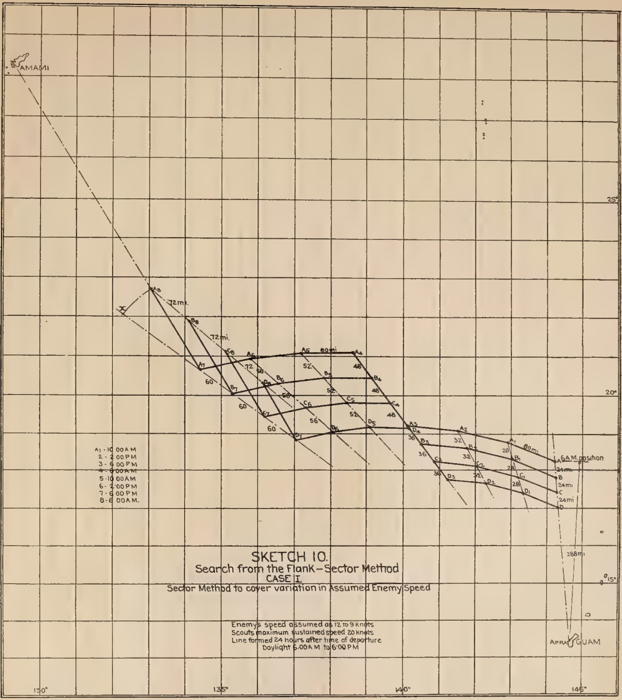
The search is conducted as in Case I, except that as there is no variable factor in this equation, this distance between scouts remains fixed, and therefore the speed of the inner scouts should be such as to maintain them on the proper radius and at the fixed distance from the scout next farther from the enemy's point of departure.

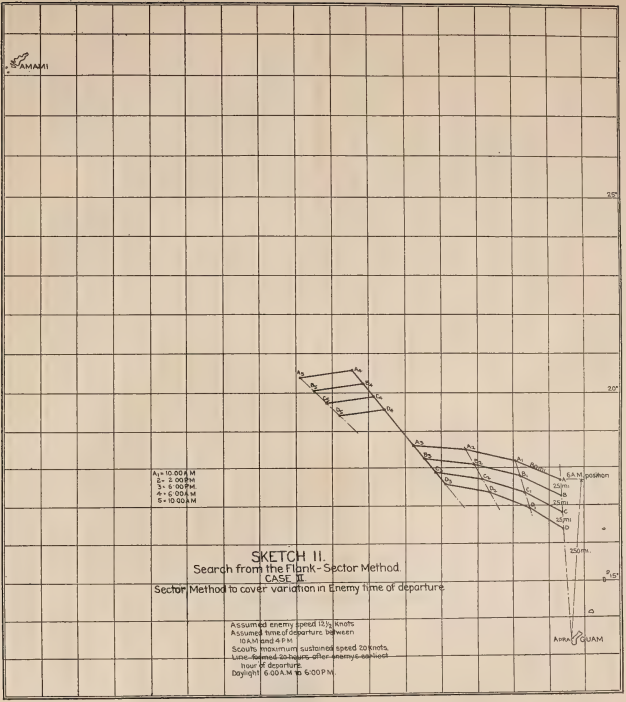
CASE III.

(Sketch 12.)

SECTOR SEARCH AT MAXIMUM DISTANCE.

In the second form above, Case II, the distance between scouts remains constant. In case the enemy's time of departure was not


AMAMI
GUAM
APRA
6 A.M. position
A1 - 10 00 A M
2 - 2 00 P M
3 - 6 00 P M
4 - 6 00 A M
5 - 10 00 A M
6 - 2 00 P M
7 - 6 00 P M
8 - 6 00 A M.
SKETCH 10.
Search from the Flank—Sector Method
CASE I.
Sector Method to cover variation in Assumed Enemy Speed
Enemys speed assumed as 12 to 9 Knots
Scouts maximum sustained speed 20 Knots
Line formed 24 hours after time of departure
Daylight 6.00 A M to 6.00 P M
130°
135°
140°
145°
15°
20°
25°
288 mi
72 mi.
80 mi



SKETCH II.
Search from the Flank - Sector Method.
CASE II.
Sector Method to cover variation in Enemy time of departure

known, between certain limits, the distance between scouts should be made a maximum, i. e., twice the radius of visibility.

In Sketch 12 is shown a group of scouts using this method at maximum scouting distance. Notice the similarity between this and a line of scouts using the search from ahead.

This form is the closest approach to the method of search from ahead as conducted from a flank. It covers the widest front of any method of using the retiring search. It does not cover as great an angular distance as the independent or patrol methods. It does not maintain as much concentration of the scouting force as the forms shown in Case I and Case II.

CONDUCT OF SECTOR SEARCH DURING UNFAVORABLE VISIBILITY CONDITIONS.

The sector method is a method in which the movements of several scouts are coordinated. Unfavorable visibility conditions, which affect one or more of the scouts, seriously reduce the efficiency of such co-ordination.

In order to maintain its efficiency the scouts must retire along the radius from the enemy's point of departure or toward the assumed destination during unfavorable conditions. This operation is in its nature the same as in the search from ahead, i. e., retire on enemy's assumed course at enemy's assumed speed, the enemy's course being assumed as the radius from the enemy's point of departure, passing through the scout's position; and the enemy's speed the speed assumed for the enemy by the scouts.

The scout encountering fog or other unfavorable conditions immediately changes its course to that of the radius through the enemy's point of departure and reduces its speed to enemy's assumed speed.

Upon instructions from the scout commander, the line is re-formed on the scout which first started the retirement.

In Sketch 12 is shown the method of procedure when unfavorable weather conditions are encountered.

Scout C encountered unfavorable visibility conditions at 9 A. M., changed course and speed as indicated above, and notified the scout commander on Scout D. Scout D immediately changed course to regain positions on Scout C. At the same time Scouts A and B were directed to retire and re-form the line on C. By noon the line has been re-formed on Scout C.

By 1.30 P. M. all scouts have reported conditions favorable and the scout commander directs all scouts to continue the search at 2 P. M. The courses from 2 P. M. to 6 P. M. are marked A_6, A_7, etc.

WHEN TO USE SECTOR METHOD.

This method is used when it is desirable to search from the flank, and the number of ships available is sufficient to cover the probable

inaccuracies in the assumptions; or, the third form, to cover as great an area as possible from the flank.

The third form may be used to cover any desired area by assuming a point of departure and an enemy speed upon which to base the operation; or, when the scouting force is nonhomogeneous and it is desired to make use of each ship to the maximum of its speed.

ADVANTAGES OF SECTOR METHOD.

The sector method has the following advantages:

1. Maintains the greatest concentration of scouts of any form of the retiring search.

2. Permits a concentrated scouting line even with a non-homogeneous force.

3. Affords, by extension of distance to the maximum, a method of covering the greatest variation in enemy assumed speeds or times of departure when using retiring search.

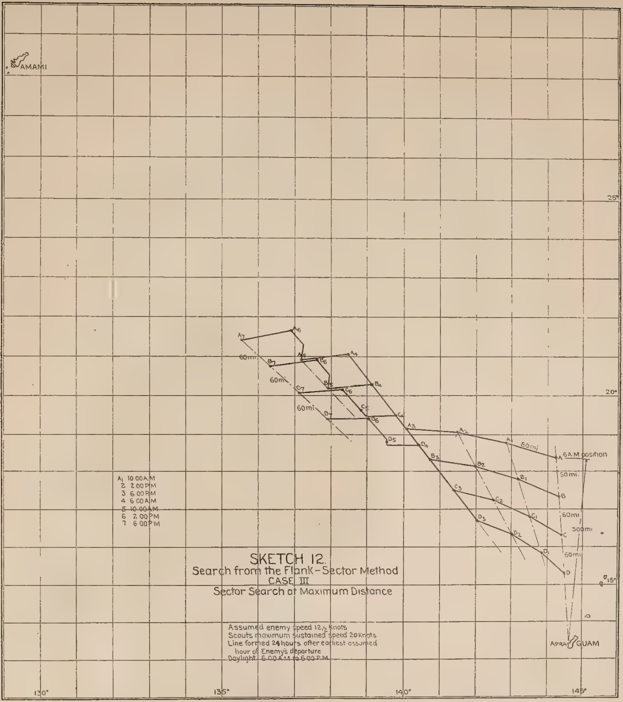
It has the following disadvantages:

1. If scouting force is homogeneous, it does not make use of the maximum speed of all scouts.

2. The position for starting the search is usually difficult to obtain.

3. Requires high speed and consequent great fuel consumption.

4. Search must start from a flank.


AMAMI
25°
20°
15°
130°
135°
140°
145°
APRA
GUAM
A1 10 00 A.M
2 2 00 P.M
3 6 00 P.M
4 6 00 A.M
5 10 00 A.M
6 2 00 P.M
7 6 00 P.M
6 A.M position
60 mi
30 mi
300 mi
SKETCH 12.
Search from the Flank-Sector Method
CASE III
Sector Search at Maximum Distance
Assumed enemy speed 12½ Knots
Scouts maximum sustained speed 20 Knots
Line formed 24 hours after earliest assumed hour of Enemy's departure
Daylight 6.00 A.M to 6.00 P.M.

CHAPTER X.

QUESTIONS AND ANSWERS—SECTOR METHOD.

CHAPTER X.

QUESTIONS AND ANSWERS—SECTOR METHOD.

(Sketch 13.)

Question 1. A group of 4 scouts is to start a sector search for a force which left port 36 hours before the line is to be formed; the scouts are directed to cover enemy speeds 10 to 13 knots.

At what distance from the point of departure would be the scout which is to use the 13-knot assumption at the time the line is formed?

Answer. $36 \times 13 = 468$ miles.

Question 2. How far apart will the scouts be at the time the line is formed, 6 A. M.? How far apart at 10 A. M.? At 2 P. M.? At 6 P. M.?

Answer. Scouts assume different speeds, 13, 12, 11, 10.

$x=1$, $y=36$, $xy=36$ miles at 6 A. M.=distance apart.

At 10 A. M., $x=1$, $y=40$, $xy=40$ miles=distance apart.

At 2 P. M., $x=1$, $y=44$, $xy=44$ miles=distance apart.

At 6 P. M., $x=1$, $y=48$, $xy=48$ miles=distance apart.

Question 3. Assuming scouting line north, the course to be changed three times during the day, and the exterior scout's speed as 20 knots, how many degrees will the sector search cover for this day?

Answer. An angle of $20\frac{3}{4}°$ from enemy's point of departure is covered on this day.

Question 4. What will be the course and speed of the inner scout from 6 A. M. to 10 A. M.?

Answer. Course 307°, speed 15 knots.

Question 5. A group of 4 scouts is to start a sector search for a force whose earliest hour of departure was 48 hours before the line is formed; the scouts are instructed to assume enemy speed as 11 knots, and to search the area for a variation of 9 hours between enemy's earliest and latest time of departure.

How far apart will the scouts be when the line is formed? How far at 10 A. M.? How far at 2 P. M.?

Answer. Number of scouts, 4. Number of spaces, 3.

$9/3=3$ hours variation in assumed time of departure.

Distance apart of scouts, 33 miles.

The distance is maintained.

Question 6. Assuming the speed of the exterior scout as 20 knots, how many degrees will the sector search cover for this day?

Answer. An angle of $20\frac{1}{2}°$ from the enemy's point of departure is covered on this day.

Question 7. What will be the course and speed of the interior scout from 6 A. M. to 10 A. M.?

Answer. Course, 304°; speed, 17 knots.

Question 8. If, in the above cases, the scouts were in a heavy fog at 6 A. M., what would be the procedure in each case?

Answer. Case I. Retire along radius from enemy's point of departure at enemy's assumed speed. $S_1=13$ knots, $S_2=12$, $S_3=11$, $S_4=10$.

Case II. Retire along radius at enemy's estimated speed. All scouts at 11 knots.

Question 9. A group of 4 scouts at COFFIN BAY is directed to search by the sector method for a Blue force which left APRA, GUAM, 1 August at 10 A. M., assumed maximum speed 12 knots. The scouts leave COFFIN BAY 2 August at 6 A. M. The scout commander decides to search westward from line bearing north from APRA, and to cover the widest possible front. How, when, and where would the line be formed, assuming scouts of speeds 20, 19, 18, 17?

Answer. If the line is formed at daylight, the 17-knot ship can not reach the interior position. We, therefore, have 3 choices of a method of procedure.

(*a*) The 3 northern ships can start the search at daylight, the southern ship proceeding at maximum speed along the radius toward the enemy's point of departure until it is necessary for her to change course to arrive at her position for 10 A. M.

(*b*) Place a faster ship to the southward.

(*c*) Delay the formation of the line until 8 A. M.

Course (*a*) causes a reduction in efficiency for the first 3 hours of search, but permits the line to be moved to the westward at its highest speed after 6 A. M.

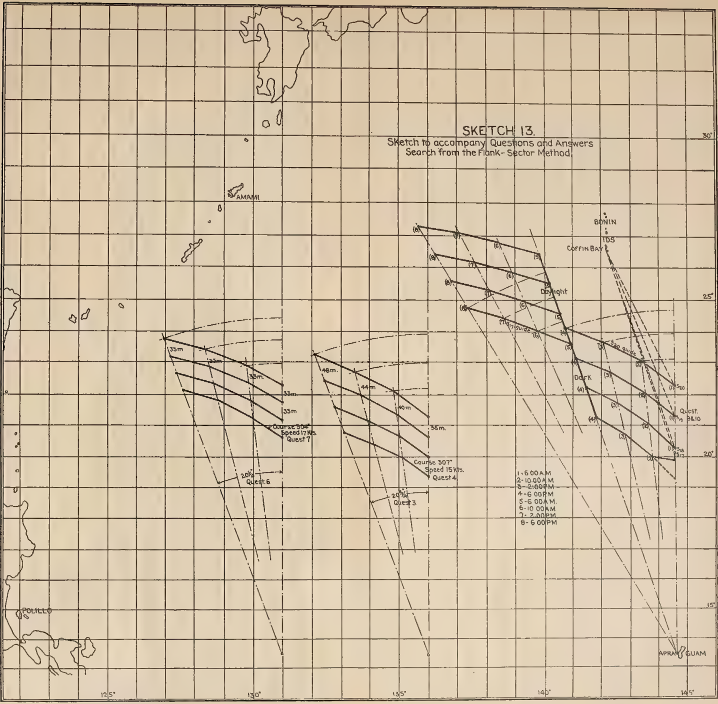
Courses (*b*) and (*c*) reduce the angular distance covered by all scouts.

Course (*a*) is considered the best. Method shown in Sketch 13.

On the second day, the slowest ship will have to be used as the guide, as her speed is insufficient to cover an arc equal to that covered by the exterior scout at a speed of 20 knots.

Question 10. Draw the tracks of these scouts for 36 hours after the line is formed. Assume daylight 6 A. M. to 6 P. M.

Answer. Tracks of scouts are shown in Sketch 13.



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SEARCH METHOD EXERCISE 3.

SEARCH FROM THE FLANK—SECTOR METHOD.

Motives.—Exercise in the conduct of search operations. Sector Method.

Study of the influence of fog on search operations.

General situation.—War exists between Orange and Blue. Blue has established an advance base at AMAMI O SIMA. After an indecisive though severe engagement off SIMONOSEKI the Orange fleet retired into the inland sea. The Blue fleet retired to AMAMI.

On 30 March, at noon, the commander of an Orange raiding force based at PORT LLOYD, BONIN ISLANDS, learned that a Blue convoy of 10 supply ships, with stores for the Blue fleet, left APRA, GUAM, on 30 March, about 5.30 A. M., escorted by a division of armored cruisers and a squadron of second-class cruisers.

The commander of the Orange raiding force, consisting of 2 battle cruisers and 4 second-class cruisers, based at PORT LLOYD, BONIN ISLANDS, decided to intercept and destroy the Blue convoy and escort.

Special situation.—On 1 April, at 5.30 A. M., the Orange second-class cruiser division, under command of Rear Admiral OQ, is in the position indicated by, and acting under the following orders [extract from campaign order No. 3]:

3. (a) Scouts search westward from line bearing zero from APRA, assume enemy speeds eleven to nine and one-half. Sector method. Scouting speed twenty. Assume enemy departure thirty March, five-thirty A. M. Start search one April, five-thirty A. M.

Required.—A sketch showing the track of each ship of the division from 1 April, 5.30 A. M., to 3 April, 5.30 A. M., with a note of each change of course and speed and reason for change, under the following assumptions:

ASSUMPTIONS GOVERNING SOLUTION.

1. Daylight, 5.30 A. M. to 6.30 P. M.
2. Maximum sustained speed of second-class cruisers is 20 knots.
3. In running retiring search, course is to be changed four times during daylight.
4. During 1 April the weather is fair and clear.
5. On 2 April, 8.45 A. M., the two northern ships run into a dense fog. The scout commander directs the division to retire along the radius from APRA.
6. On 2 April, 11 A. M., the fog over the two northern ships lifts and the weather is clear.

7. On 2 April, 5 P. M., the squadron commander receives the following radio message:

ORANGE RAIDING FORCE,
BB–1, FLAGSHIP,
LAT. TWENTY-SEVEN, LONG. ONE THIRTY-SIX.
2 APRIL, 4 P. M.

No further news of enemy. Battle cruisers in Lat. twenty-seven, Long. One thirty-six; course two seventy; speed twelve. Will retire two April, six-thirty P. M., toward AMAMI.

Scouts retire toward AMAMI during night second/third April. Continue search on three April by present method.

[S] ON,
Vice Admiral.

SEARCH METHOD EXERCISE 3.

SEARCH FROM THE FLANK—SECTOR METHOD.

SOLUTION.

(Sketch 14.)

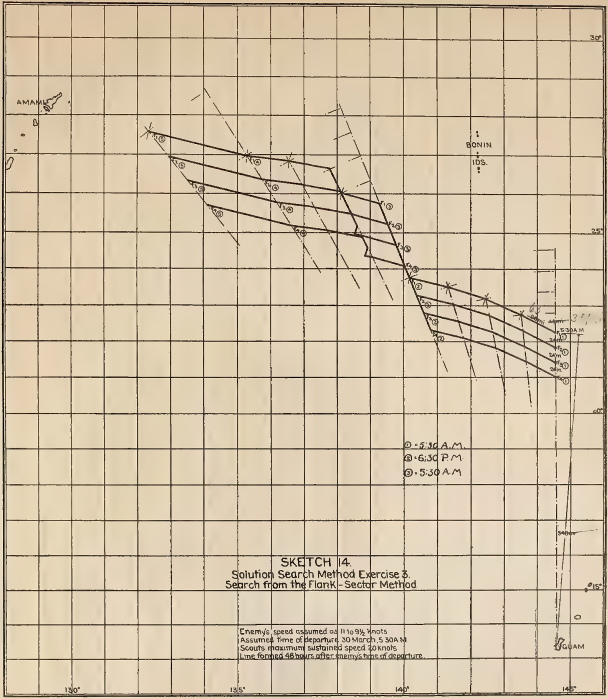
The scouts take position on April 1 at 5.30 a. m. on the line bearing 0° from APRA. The northern scout at the meeting point, assuming enemy departure March 30, 5.30 a. m., speed 11 knots. The other scouts are at meeting points for enemy assumed speeds $10\frac{1}{2}$, 10 and $9\frac{1}{2}$ knots.

F–1 runs a retiring search curve for assumed enemy speed, 11 knots, changing course every $3\frac{1}{4}$ hours. The other scouts direct their course and speed so as to arrive at the same radius from APRA, at the same time as *F–1*. The distance between scouts at daylight is $48 \times \frac{1}{2}=24$ miles. In $3\frac{1}{4}$ hours this distance should increase $3\frac{1}{4} \times \frac{1}{2}=\frac{13}{8}=1\frac{5}{8}$ miles. As the scouts arrive at each radii at which changes of course are to be made, their distance is increased by $1\frac{5}{8}$ miles. At dark the scouts are $24+4\ (1\frac{5}{8})=30\frac{1}{2}$ miles apart.

They retire during the night along the same radius from APRA, but increase their scouting distance during the night by $\frac{11}{2}=5\frac{1}{2}$ miles.

At daylight the search is resumed in the same manner. At 8.45 A. M. the two northern scouts encounter fog and retire along the radius from APRA. The two southern scouts when informed of this movement direct their course to regain their position with reference to the leader. When the fog lifts, the two northern ships notify the scout commander and he directs that at noon the search be continued.

At dark the scouts are directed to retire toward AMAMI. The guide, *F–1*, directs course and speed to reach a position on course toward AMAMI, but also on the Blue 11-knot position circle for daylight 3 April. The other scouts form on the radius to APRA, passing through the position of the guide, scouting distance $\frac{96}{2}=48$ miles. The search would be conducted as on the previous day.



SKETCH 14.
Solution Search Method Exercise 3.
Search from the Flank - Sector Method

CHAPTER XI.

THE SEARCH FROM THE FLANK (CONTINUED). PATROL METHOD.

CHAPTER XI.

PATROL METHOD

OF USING THE RETIRING SEARCH.

GENERAL.

In the previously described methods of using the retiring search, the ships of the groups have been disposed to cover enemy speeds lower than the enemy's assumed maximum, or hours of departure later than the enemy's assumed earliest hour of departure.

This disposition of the scouts limits the angle of enemy's possible courses searched in one day, to that which could be covered by one scout steaming a retiring search at its maximum speed under the assumed conditions of enemy's maximum speed and earliest hour of departure.

There will frequently be cases where it is necessary to cover an area, for the assumed conditions, greater than that which can be covered by one scout.

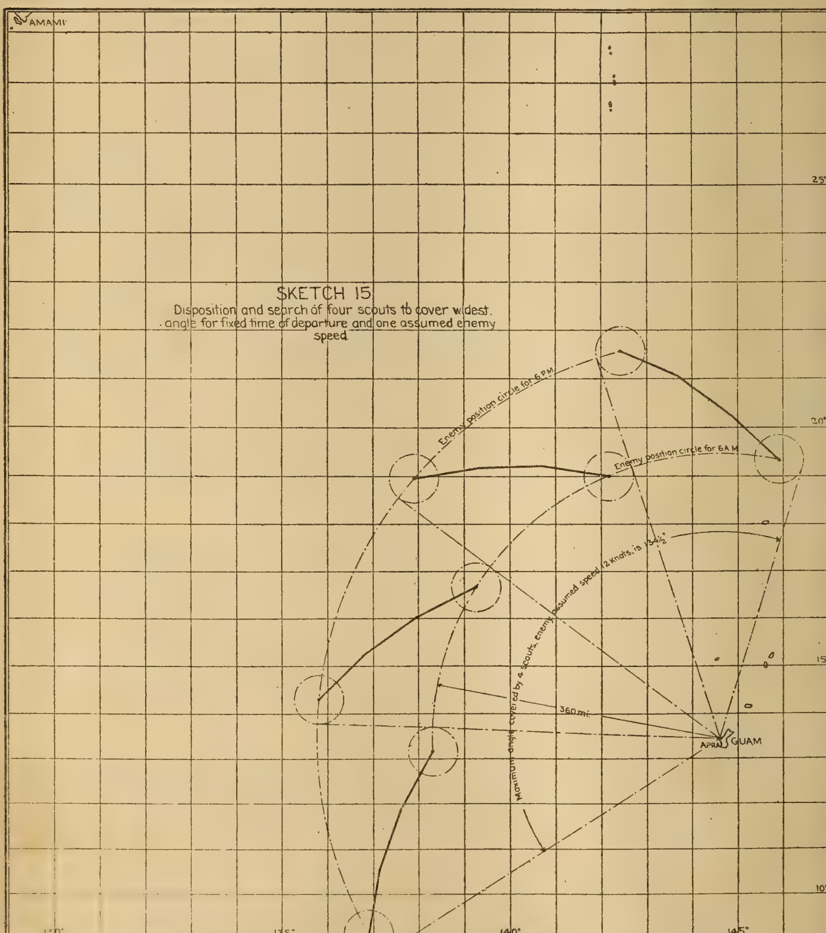
If only one enemy assumed speed is to be examined, the most efficient method is to place the scouts on an enemy daylight circle, on different radii, at distances apart such that, by the end of the day, each, except the one on the flank toward which the search curve is run, will have covered the area between the radius from the enemy's point of departure through its initial position, and that through the initial position of the next adjacent scout.

In this method the scouts only cover an enemy speed near to the one they have assumed. The dispersion of the scouts is very rapid. There would be difficulty in reaching the positions from which to start such a search.

Sketch 15, page 108, shows 4 scouts disposed to cover the greatest possible angular distance under the following conditions: Enemy force leaves APRA 30 hours before the search begins. Search begins at daylight, which is of 12 hours' duration. Enemy speed, 12. Scouts' maximum speed, 20.

This idea, covering a wide area, for the enemy's maximum assumed speed led, as was seen in Sketch 15, to the disposition of the scouts on an enemy position circle. That is, at the time the search was started all scouts were equally distant from the enemy's point of departure.

The rapid dispersion of the scouting force and its small efficiency for conditions other than the one enemy speed and time of departure assumed, in using the above method, showed that it was necessary to modify the method to make it of much practical value. It is not desirable for each scout to run a retiring search, for by doing so the scouts are dispersed and also forced to increase their distance from the enemy's point of departure.



The investigation to determine a better method was based on the following as desirable conditions:

The scouts are to cover the widest possible angle for the assumptions of enemy maximum speed and earliest hour of departure consistent with covering as many other assumptions as possible, maintaining an efficient concentration, and retiring the scouts the least possible distance.

The result was the Patrol Method of using the retiring search.

Now OB = $\frac{\quad}{E}$ and = x + z = $\frac{\quad}{E}$.

(2) $x = \frac{RS}{E} - z.$

Now $\frac{z}{y} = \frac{S}{E}.$

(3) $z = y\frac{S}{E}.$

From (2) and (3) $x = \frac{RS}{E} - \frac{yS}{E}.$

From (1) and (3) $R^2 - y^2 = \frac{S^2}{E^2} (R-y)^2$

Dividing by R - y.

PATROL METHOD.

Addendum to insert (320) at p 108 Text Book.

(By Commander G. J. Rowcliff, U.S. Navy.)

I

To find point P where Scout B picks up enemy proceeding along OM.

Diagram I

A scout at speed S starts from B towards A (another Scout) to sight an enemy proceeding from O to M (normal to AB) at speed E.

Let R = radius of visibility.

By the problem BC = AO = OM = R.

$AB = R + \frac{RS}{E}$ or

$OB = \frac{RS}{E}$

After leaving B, scout proceeds to P and sights enemy, having travelled a distance z, and having to travel x.

The enemy has travelled a distance to Q = y.

(1) At this point $x^2 + y^2 = R^2$ or $x^2 = R^2 - y^2$.

Now $OB = \frac{RS}{E}$ and $= x + z = \frac{RS}{E}$.

(2) $x = \frac{RS}{E} - z$.

Now $\frac{z}{y} = \frac{S}{E}$.

(3) $z = y\frac{S}{E}$.

From (2) and (3) $x = \frac{RS}{E} - \frac{yS}{E}$.

From (1) and (3) $R^2 - y^2 = \frac{S^2}{E^2} \quad (R-y)^2$

Dividing by R - y.

The above applies only to the case where the enemy crosses the line of scouts on a normal course and holds that course.

Example:-

Let R = 25; S = 30; E = 20.

The enemy travels before being caught

$$y = \frac{R(S^2 - E^2)}{S^2 + E^2} = 9{,}23 \text{ m.}$$

$$OB = \frac{RS}{E} = 37{,}5 \text{ m,}$$

$$\text{Time} = \frac{37{,}5}{30} = 1{,}25 \text{ hr.}$$

$$R + y = \frac{S^2}{E^2}(R-y)$$

(4) Solving: $y = \frac{R(S^2 - E^2)}{S^2 + E^2}$ = distance travelled by enemy.

From (3) and (2) $y\frac{S}{E} = \frac{RS}{E} - x$;

$$\frac{S}{E}\left(\frac{R(S^2 - E^2)}{S^2 + E^2}\right) = \frac{RS}{E} - x,$$

Solving: $x = \frac{2\ SER}{S^2 + E^2}$

(5) From (2) $z = \frac{RS}{E} - \frac{2\ SER}{S^2+E^2}$ = distance travelled by scout.

(4) and (5) give the points at which scout picks up enemy.

Let α = relative bearing of enemy from scout.

Let β = relative bearing of scout from enemy.

At this point:

$$\frac{\sin\alpha}{\sin\beta} = \frac{y}{x} = \frac{\frac{R(S^2 - E^2)}{S^2 + E^2}}{\frac{2\ SER}{S^2 + E^2}} = \frac{R(S^2 - E^2)}{2\ SER}$$

$$\beta = 90 - \alpha$$

$$\therefore \frac{\sin\alpha}{\cos\alpha} = \tan\alpha = \frac{R(S^2 - E^2)}{2\ SER}$$

From this point scout B continues to advance, closing distance from enemy until a point P_1 is reached when the distance begins to increase; and scout after passing this point P_1 never comes any closer to enemy.

The above applies only to the case where the enemy crosses the line of scouts on a normal course and holds that course.

Example:-

Let R = 25; S = 30; E = 20.

The enemy travels before being caught

$y = \frac{R(S^2 - E^2)}{S^2 + E^2} = 9.23$ m.

$CB = \frac{RS}{E} = 37.5$ m.

Time $= \frac{37.5}{30} = 1.25$ hr.

Diagram II

At this point, the distance $P_1 Q_1$ is a minimum, and the decrement $L P_1$ = increment $N Q_1$.

$$\frac{KP_1}{M_1 Q_1} = \frac{St}{Et}.$$

$$x = \frac{2\ SER}{S^2 + E^2} = 23.1 \text{ m.}$$

$$z = 37.5 - 23.1 = 14.4 \text{ m.}$$

∴ Scout B picks up enemy at point P after travelling 14.4 miles in 28.8 minutes.

Thereafter scout B closes distance until P_1 is reached, and thereafter the distance begins to open.

II

To find point P_1 in scout's advance at which he is closest to enemy running from O to M at speed E.

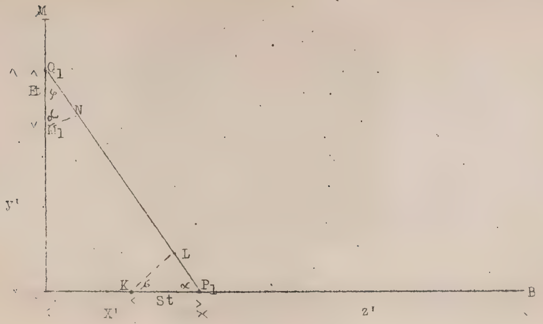


Diagram II

At this point, the distance $P_1\ Q_1$ is a minimum, and the decrement $L\ P_1$ = increment $N\ Q_1$.

$$\frac{KP_1}{M_1\ Q_1} = \frac{St}{Et}.$$

$$\therefore z^1 = BO - \left[BO - S \left(\frac{S(BO)}{E^2 + S^2} \right) \right] = \frac{S^2 (BO)}{E^2 + S^2}$$

But $BO = \frac{RS}{E}$

(9) $\therefore z^1 = \frac{RS}{E} \left(\frac{S^2}{E^2 + S^2} \right)$, which is the distance the Scout runs from origin B to arrive at a point P_1 where he no longer accomplishes anything toward closing the enemy running at a speed E from O to OM on a course normal to the line of scouts. Example:-

$$\cos \alpha = \frac{LP_1}{St} \text{ and } \sin \alpha = \frac{Q_1N}{Et}$$

$$\frac{\sin \alpha}{\cos \alpha} = \frac{\frac{Q_1N}{Et}}{\frac{LP_1}{St}} = \left(\frac{Q_1N}{Et}\right) \left(\frac{St}{LP_1}\right) = \frac{S}{E}$$

(6) $\therefore \tan \alpha = \frac{S}{E} = \frac{y}{x}$

(7) $\therefore \frac{y^1}{x^1} = \frac{S}{E}$

So, when ratio of distance to be travelled by scout to distance travelled by enemy is inversely as their speeds, the scout does not shorten the distance, but on the contrary, the enemy begins to draw away.

Now let T_1 = the time scout and enemy have been running.

(8) $y^1 = ET_1$ and $x^1 = BO - ST_1$

From (7) and (8)

$$\frac{ET_1}{BO - ST_1} = \frac{S}{E}$$

$$E^2 T_1 = S(BO) - S^2 T_1$$

$$T_1 = \frac{S(BO)}{E^2 + S^2}$$

From (8) $x^1 = BO - S \left(\frac{S(BO)}{E^2 + S^2}\right)$

$$x^1 + z^1 = BO$$

$$z^1 = BO - x^1$$

$$\therefore z^1 = BO - \left[BO - S \left(\frac{S(BO)}{E^2 + S^2}\right)\right] = \frac{S^2 (BO)}{E^2 + S^2}$$

But $BO = \frac{RS}{E}$

(9) $\therefore z^1 = \frac{RS}{E} \left(\frac{S^2}{E^2 + S^2}\right)$, which is the distance the Scout runs from origin B to arrive at a point P_1 where he no longer accomplishes anything toward closing the enemy running at a speed E from O to OM on a course normal to the line of scouts. Example:-

At this point P_1, the distance $P_1 Q_1$ is a minimum and equal to R.

The decrement LP_1 = increment NQ_1

$$\frac{KP_1}{MQ_1} = \frac{St}{Et}$$

From (6) $\tan \alpha = \frac{S}{E} = \frac{y^1}{x^1}$

From (11) and (6)

$$\frac{z^1}{x^1} = \frac{S^2}{E^2} \text{ and } (y^1)^2 = x^1 \ z^1$$

$R = 25$; $S = 30$; $E = 20$; $\frac{RS}{E} = 37.5$

$$z^1 = 37.5\left(\frac{900}{900+400}\right) = 37.5\left(\frac{9}{13}\right) = 26 \text{ miles.}$$

After running 26 miles, the scout accomplishes nothing towards closing this particular enemy.

III

Since, as shown above, Scouts running a patrol, spaced according to the text $AB = R + \frac{RS}{E}$, no longer close an enemy crossing the line normal after they have steamed a distance represented by $\frac{RS}{E}\left(\frac{S^2}{S^2+E^2}\right)$, this fact may be taken advantage of to increase the distance AB.

To find the distance from A to B at which the scouts may be spaced and yet not fail at speed S to sight an enemy proceeding at speed E from O to M on a course normal to the line of scouts.

Refer to Diagram II.

(10) $(x^1)^2 + (y^1)^2 = R^2$

$CB = x^1 + z^1$

(11) $\frac{z^1}{y^1} = \frac{S}{E}$

$\sin\alpha = \frac{y^1}{R}$

$\cos\alpha = \frac{x^1}{R}$

$\therefore \tan\alpha \;\; \frac{y^1}{x^1}$

At this point P_1, the distance P_1Q_1 is a minimum and equal to R.

The decrement LP_1 = increment HQ_1

$\frac{LP_1}{HQ_1} = \frac{St}{Et}$

From (6) $\tan\alpha = \frac{S}{E} = \frac{y^1}{x^1}$

From (11) and (6)

$\frac{z^1}{x^1} = \frac{S^2}{E^2}$ and $(y^1)^2 = x^1 z^1$

$E\sqrt{S^2 + E^2}$

instead of $R + \frac{RS}{E}$ miles as demonstrated in the original text.

Example:-

$R = 25; \quad S = 30; \quad E = 20.$

$R + \frac{RS}{E} = 25 + 37.5 = 62.5$ miles.

We have now found that these scouts could have been spaced

$$R + \frac{R(S^2 + E^2)}{E\sqrt{S^2 + E^2}} = 25 + 45 = 70 \text{ miles.}$$

Substitute in (10)

$(x^1)^2 + x^1 z^1 = R^2$

or

(13) $x^1(x^1 + z^1) = R^2$

Now let $y^1 = tE$; $z^1 = tS$

From (10) $(x^1)^2 = R^2 - (y^1)^2 = R^2 - t^2 E^2$

$x^1 = \sqrt{R^2 - t^2 E^2}$

$x^1 + z^1 = \sqrt{R^2 - t^2 E^2} + tS$

Substituting in (13)

$\left(\sqrt{R^2 - t^2 E^2}\right)\left(\sqrt{R^2 - t^2 E^2} + tS\right) = R$

Solving

$$t = \frac{SR}{E\sqrt{S^2 + E^2}}$$

$$z^1 = St = \frac{S^2 R}{E\sqrt{S^2 + E^2}}$$

From (12) $x^1 = z^1 \dfrac{E^2}{S^2} = \dfrac{ER}{\sqrt{S^2 + E^2}}$

(14) $\therefore\ x^1 + z^1 = \dfrac{R(S^2 + E^2)}{E\sqrt{S^2 + E^2}}$

This is the distance scout B, in motion, can cover to the front. Scout A, in motion, can cover a like distance to the rear, assuming continuing daylight. Assuming however that they are on the line at daylight, they can be spaced apart $R + \dfrac{R(S^2 + E^2)}{E\sqrt{S^2 + E^2}}$ instead of $R + \frac{RS}{E}$ miles as demonstrated in the original text.

Example:-

$R = 25$; $S = 30$; $E = 20$.

$R + \frac{RS}{E} = 25 + 37.5 = 62.5$ miles.

We have now found that these scouts could have been spaced

$$R + \frac{R(S^2 + E^2)}{E\sqrt{S^2 + E^2}} = 25 + 45 = 70 \text{ miles.}$$

(WWP/AAD 21 Feb.1920)

This distance can not be used for that part of the scouting line which is retiring from the point of origin on enemy position circle. It can be safe only along the enemy position circle arc

(WWP/AAD 21 Feb.1920)

to reach point O before Enemy passes outside of point M.

The Enemy can go from O to M in $\frac{r}{s}$ hours. In this time Scout B can go $\frac{r}{s} \times S$ miles.

Therefore: $AB = r + \frac{r}{s} \times S$.

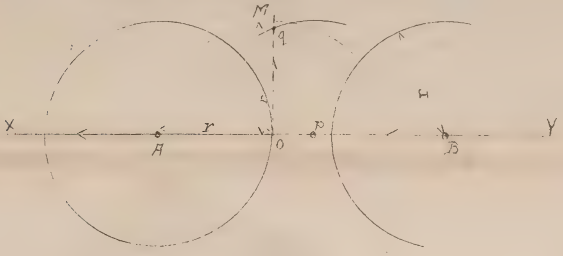
Note:- As Scout B moves towards point O there is some point reached at which Scout B will be nearer to the Enemy than at any other time. This is due to the fact that after passing point p the intersection of Scout B's visibility circle with the line OM travels at a slower rate towards point M than the

PATROL METHOD.

(Pye - Pages 109-112, 120, 121.)

The following graphic method of deducing the formulae for the maximum distances between adjacent Scouts in the Patrol Method of Retiring Search are presented:-

(a) At beginning of search when Scouts are formed on Enemy position circle.



Let r = Radius of visibility.

s = Enemy speed (assumed maximum).

S = Scouting speed.

XY - Enemy position circle.

Suppose A and B are two adjacent scouts.

Required: Distance AB.

O is the most advantageous position for Enemy when beginning search. At this time Scout A covers distance r to [illegible]. Then Scout B must not be so far from O that he will be unable to reach point O before Enemy passes outside of point M.

The Enemy can go from O to M in $\frac{r}{s}$ hours. In this time Scout B can go $\frac{r}{s}$ x S miles.

Therefore: AB = $r + \frac{r}{s} \times S$.

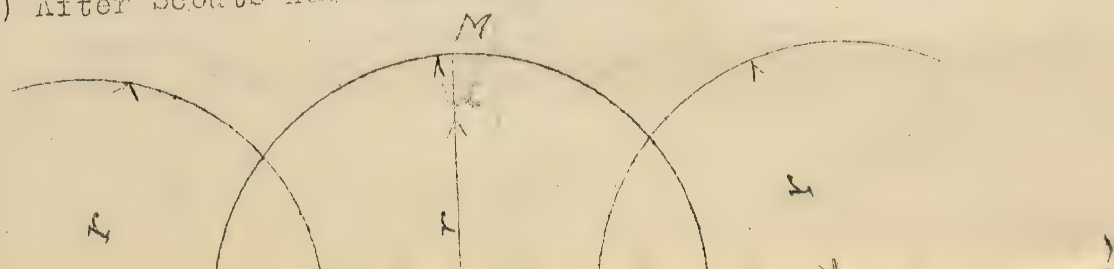
Note:- As Scout B moves towards point O there is some point reached at which Scout B will be nearer to the enemy than at any other time. This is due to the fact that after [illegible] point p the intersection of Scout B's visibility circle and the line OM travels at a slower rate towards point M than the [illegible]

(330)

Enemy. Therefore if Scout B has not sighted the Enemy when he was at some point q ($pq = r$), Scout B will not be able to see the Enemy when Scout is between points p and O.

This might be taken advantage to increase the distance AB given by the formula above. But to allow for possible errors in navigation the formula $AB = r + \frac{r}{S} \times S$ is used instead of the theoretical maximum.

(b) After Scouts have been in motion for a time.

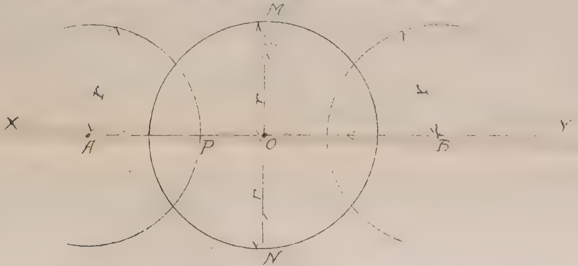


tance which circumstances will [illegible]

Enemy. Therefore if Scout B has not sighted the Enemy when he was at some point q (pq = r), Scout B will not be able to see the Enemy when Scout is between points p and q.

This might be taken advantage to increase the distance as given by the formula above. But to allow for possible errors in navigation the formula AB = $r + \frac{r}{S} \times S$ is used instead of the theoretical maximum.

(b) After Scouts have been in motion for a time.



When Scout A was at O the Enemy could not have been inside of distance r without being seen.

Enemy could go from N to O in $\frac{r}{S}$ hours. In this time Scout A could travel from O to A = $\frac{r}{S} \times S$ miles.

As in Case (a) above, Scout B covers to the front a distance $\frac{r}{S} \times S$.

Hence once in motion then A covers a distance to his rear along the line XY = $\frac{r}{S} \times S$ and B covers a distance to his front along this line = $\frac{r}{S} \times S$.

Therefore, AB = $\frac{2r}{S} \times S$.

(c) In the deduction of the formulae above in Case (a) it was assumed that the Enemy might have reached a point on the line of scouts by the time the search was started. In Case (b) it was assumed that the Enemy had not yet reached that line.

Summarizing, then, the above two formulae [illegible]

at (1) How long Scouts must be in motion before formula in (b), i.e., $d = \frac{2r}{s} \times S$ is effective, and (2) How far the Scouts must be formed outside the Enemy position circle in order that they may be placed at this distance $(\frac{2r}{s} \times S)$.

(1) The distance by (b) $= \frac{2r}{s} \times S$.

The distance by (a) $= r + \frac{r}{s} \times S$.

The difference in distance between adjacent Scouts in cases (b) and (a) is:

$$\left(\frac{2r}{s} \times S\right) - \left(r + \frac{r}{s} \times S\right) = r\left(\frac{S}{s} - 1\right).$$

This represents the distance the Scouts must travel from the beginning of search before formula (b) becomes effective.

(<u>Note</u>:- This distance is represented by the distance CI in diagram (b). This is the increase in distance Scouts covers to the rear by virtue of being in motion.)

The time for Scouts to run this distance =

$$\frac{r}{S}\left(\frac{S}{s} - 1\right) = r\left(\frac{1}{s} - \frac{1}{S}\right).$$

(2) The distance the Scouts must be formed outside Enemy position circle equals the distance Enemy can travel in the time deduced in (1) above, i.e., in $r\left(\frac{1}{s} - \frac{1}{S}\right)$ hours. This is $r\left(\frac{1}{s} - \frac{1}{S}\right) \times s = r\left(1 - \frac{s}{S}\right)$ miles.

The formulae in (a) and (b) give the maximum distances at which Scouts should be placed. Owing to variation in radius of visibility, errors of navigation, and for purpose of better concentration, the Scouts should be spaced at the minimum distance which circumstances will permit.

PATROL METHOD.

In order to cover the greatest angle it is necessary to place the scouts on an enemy position circle, covering the assumptions as to the enemy's highest speed and earliest hour of departure.

If the scouts remain at rest, they can cover a distance along this position circle equal to 60 times the number of scouts. Sixty miles is assumed as twice the radius of visibility. How can this arc be increased by the movement of the scouts?

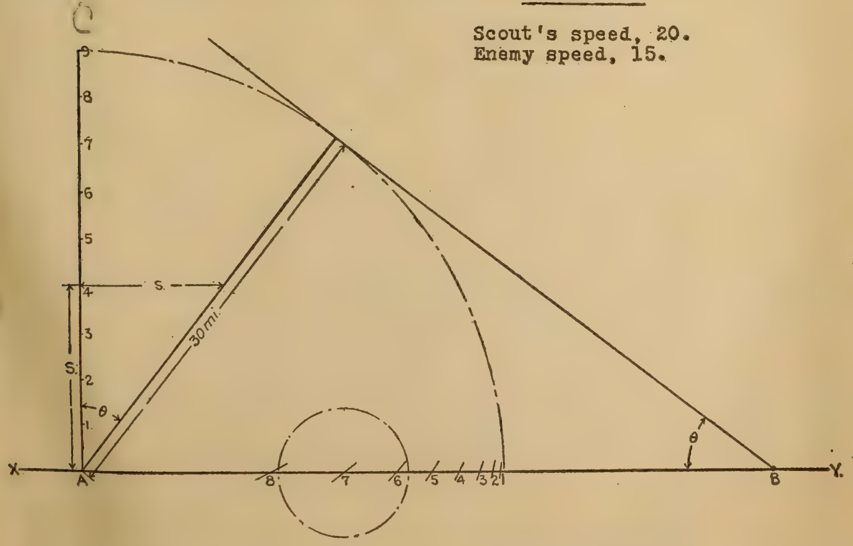
If the scout at one flank runs a retiring search for the assumed conditions, the arc would be increased. During this movement, in accordance with the desirable conditions, it was necessary to maintain an efficient concentration. If the other scouts steam along the line as formed until they reach the original position of the scout which started the retiring search curve at daylight, and then follow the track of this scout, the concentration will be maintained, and, as no force can pass through this line of scouts undetected, the line between the first and last scouts will be held. This method covers some assumptions as to lower enemy speeds or later hour of departure. It does not retire the scouts more than is required to keep one scout at the proper distance from the enemy's point of departure.

DISTANCE APART OF SCOUTS.

(Diagram 4.)

The movement of the scouts along the line passing through the position of the adjacent scout is found to have an effect on the distance at which the scouts can be placed and be effective.

DIAGRAM 4.



For consideration of this distance one scout only will be used.

Suppose the line XY to be a portion of the position line or circle upon which the scouts are disposed. The enemy force is on this line at point A.

The enemy at A is moving north on the line AC, at 15 knots speed. With successive points on this line marked 1, 2, 3, etc., as centers, describe arcs of 30-mile radius, cutting line AB, the course of the scout, in positions 1, 2, 3, etc. As the enemy moves farther and farther from point A, the distance between successive points of intersection of the circle of visibility with the line AB increases. Between points 6 and 7 this distance is slightly less than the distance covered by the scout in the same interval of time. Between points 7 and 8 the distance is slightly greater. The circle drawn with point 7 as a center has a radius equal to scouts' movement in one interval. When the enemy was in position 7, the velocity of this intersection of the position circle with the scout's course was about equal to the scout's speed.

If the scout is to see the enemy, he must arrive at point 7 on line AB by the time the enemy has arrived at point 7 on the line AC. Point 9 on this line would be at the intersection of the visibility circle with line AC.

In moving from point A to point 7, the enemy has taken $\frac{7}{9}\times\frac{30}{15}$ hours. The scout could have steamed in the same time $\frac{7}{9}\times\frac{30}{15}\times 20=$ 31.1 miles, but point 7 is 18 miles from point A.

The scout could, therefore, have been 18+31.1=49.1 miles from A when the enemy was at A, and still have seen the enemy at point 7. This is not quite the maximum distance, but indicates how it would be determined.

The maximum distance is determined by the formula:

$$\text{Cot. }\alpha=\frac{S}{s} \quad \text{sin. }\alpha=\frac{r}{c}$$

In the above case, c=50 miles.

This distance may be determined graphically as follows:

(Diagram 5.)

Let S=speed of scout; s=speed of enemy; r=radius of visibility; c=AB; d=distance between scouts.

Lay off AX proportional to s; AY proportional to S. Join XY. Draw in the circle of visability, radius r, center at A. Draw a tangent parallel to XY. AB is the distance the scout can be from A when the enemy is at A. This is c.

MATHEMATICAL CALCULATION OF C.

$\text{Cot. } \alpha = \frac{20}{15}$	$\log. 20 = 1.30103$
$\text{Sin. } \alpha = \frac{r}{d}$	$\log. 15 = 1.17609$
$c = \frac{r}{\sin. \alpha} = \frac{30}{\sin. \alpha}$	$\cot. \alpha = .12494$
$c = 50$ miles.	$\sin. \alpha = 9.77814$
	$\log. 30 = 1.47712$
	$\sin. \alpha = 9.77814$
	$\log. c = 1.69898$
	$c = 50.$

We have only considered the scout approaching the enemy after the enemy has passed the scouting line. The preceding scout would

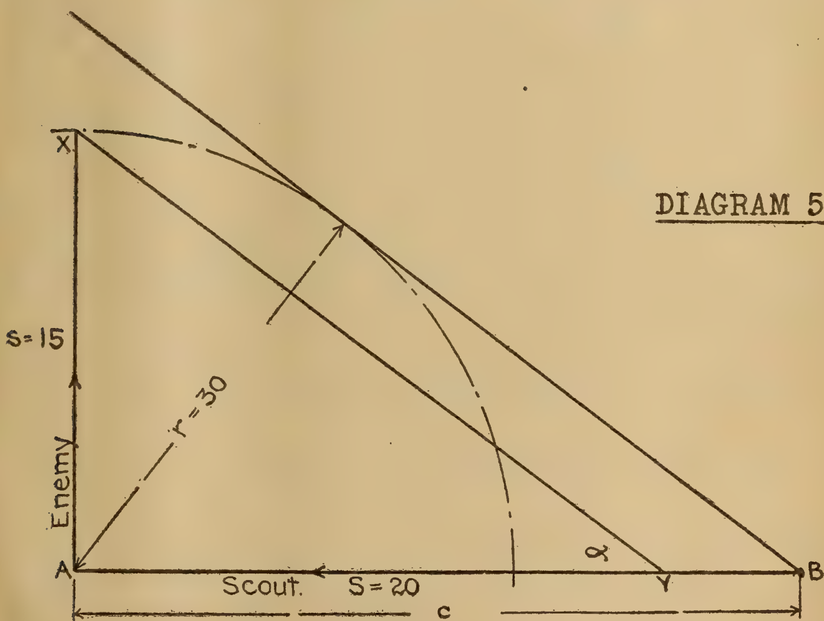


DIAGRAM 5.

have covered the same distance to the rear, if darkness had not obscured the enemy. At daylight the other scout can cover but 30 miles in rear, so the distance between scouts at daylight and dark must not be in excess of r+c, where $c = \frac{r}{\sin. \alpha}$ $\cot. \alpha = \frac{S}{s}$.

In the above case, d=30+50, or 80 miles.

The above formula extends the distance to a maximum and makes no allowance for errors in navigation, so in practice a reduced distance is advisable.

The formula used in practice is simpler, and is enough inside the theoretical maximum to allow for probable errors.

The formula for obtaining the distance between scouts when formed on the position line or circle is as follows:

$$d = r + r \times \frac{S}{s}.$$

Substituting the values of the previous example, we obtain

$d = 30 + 30 \times \frac{20}{15} = 70$ miles instead of 80, the theoretical maximum.

In this form of search, then, the scouts are formed on a line, most usually a position circle for enemy maximum speed and earliest hour of departure, at distances not exceeding that determined by the formula above. The scout on one flank runs a retiring search curve for the enemy's assumed maximum speed and earliest hour of departure. The other scouts follow the leader at the same speed, each scout passing through the original position of the scouts nearer the ~~flank~~, and following the search curve run by the leader after reaching the point of origin.

In Sketch 16, the scouts are formed on the arc of a position circle, drawn with the assumptions of the enemy's earliest hour of departure and maximum speed, and cover an arc AB, equal in length to $(n-1) \times d + 2r$, when n=number of scouts and d=distance obtained by the formula.

$$d = r + \left(r \times \frac{S}{s}\right) =, \text{ in this case,}$$

$$d = 30 + \left(30 \times \frac{20}{12.5}\right) = 78 \text{ miles.}$$

The scout A runs a retiring search to the westward, using the assumed conditions upon which the original position circle was based. At dark, he arrives at X. During the day, the sector α has been searched for the assumed conditions. This sector includes that which is seen from the ship at daylight and dark.

As scout A has just arrived at X at dark, and as scout B left B at daylight, the angle between radii, tangent to the scouts' visibility circles at these times, has been examined for speeds and times of departure near the assumed condition only.

As the scouts following A have efficiently maintained the line XB′ during the day, the interior sectors have been covered for some variations in the enemy's speed or time of departure.

In Sketch 16, the scouts have been formed on a position circle assuming the enemy to have left APRA on 1 August, 10 A. M., maximum speed $12\frac{1}{2}$ knots.

The sector covered for this assumption is the angle α. For a scout's speed of 20 knots this sector is 98°.

In this case, what is the sector covered for the same hour of departure, but an assumed enemy speed 11 knots?

First, determine at what time the enemy moving at 11 knots would arrive at the position circle AB. This circle was drawn with a radius $20\times12\frac{1}{2}=250$ miles. At 11 knots, the enemy would reach this circle $\frac{250}{11}=22.72$ hours after 1 August, 10 A. M.=2 August, 8.45 A. M.

What distance to the eastward along this position circle is covered for this assumption at 8.45 A. M.?

The eastern scout is in position D at this time. The visibility distance covered to the rear is $r\times\frac{S}{s}$, for a radius of visibility of 30 miles; this equals $30\times\frac{20}{11}=54.5$ miles.

A radius from APRA joining a position 54.5 miles on the circle to the eastward of the eastern scout's position at 8.45 A. M. is the eastern limiting radius of this sector.

To find the western limiting radius, draw a position circle for dark, 6 P. M., using the 11-knot assumption. A radius joining APRA and the point of intersection of this position circle with the visibility circle of the scout nearest this positon at dark, is the limiting radius to the west. The angle between these limiting radii, β, is the sector covered for 11 knots, in this case $79\frac{1}{2}$°.

SUMMING UP—WHEN AND HOW TO FORM THE LINE.

The line is formed on a position circle for the enemy's assumed maximum speed and earliest hour of departure, or other line limiting the enemy's position for the time at which the line is formed.

WHERE TO FORM THE LINE.

The line should be formed toward one flank of the area to be searched, and the retiring search curve run toward the other flank.

The line should be formed during, or at, daylight on the first-position line or circle in the desired area on which all scouts can reach their assigned positions.

CONDUCT OF THE SEARCH.

The scout on one flank of the line starts a retiring search for the assumed conditions. The other scouts steam at the same speed

toward the original position of this flank scout. This position is called the "Point of origin," as it is the position from which the search curve is started.

Each scout, except the flank scout, steams on chords of the position circle, passing through the original positions of all scouts between it and the point of origin, and, after reaching the point of origin, follows on the search curve.

UNFAVORABLE CONDITIONS.

In case of unfavorable visibility conditions during the day scouts encountering such conditions retire on the radius from the enemy's point of departure passing through their own position, notify the scout commander, and continue the retirement on this course until they have received orders designating a ship upon which the line is to be reformed.

Upon receiving information of the retirement of a scout the commander directs all scouts to reestablish the line on the scout which first started the retirement.

In retiring at night the commander directs the course and speed to be used, unless a new line is designated. Usually all scouts retire on parallel courses at equal speeds in order to maintain them on the proper bearing and at the proper distance.

When no information, positive or negative, is available, the course for retirement is usually the radius from the point of departure passing through the dark position of the leader, i. e., the scout which first started the search curve. See Sketch 16(1). This course may be varied to retire toward the enemy's assumed destination as has been explained in discussions of other forms of retiring search. See Sketch 16(2). It may often be desirable to form a new line based upon the negative information obtained by the previous day's search, or on other limiting conditions which affect the choice of area to be searched.

USE OF THE PATROL METHOD.

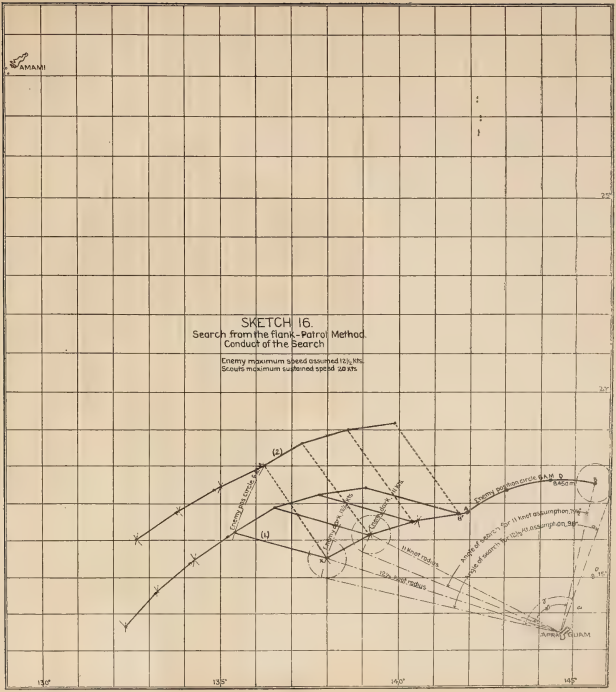
The principal advantages in the use of this method have been stated as follows:

1. To cover a wide sector for the assumed maximum speed or earliest hour of departure of an enemy force.

2. To maintain an efficient concentration.

3. To cover some reduction in the enemy assumed speed or later hour of departure.

In addition to these advantages, it has two uses which often make it desirable:



26051—16. (Face p. 114.)

(a) To cover some possible courses and speeds of the enemy while taking up a position for the use of the search from ahead; used when the scouts are on the flank of the line they are to cover.

(b) To search areas where, if the enemy's speed is much below the maximum, the discovery of the enemy is not essential. This latter case occurs in problems where the conditions require the enemy to arrive at some known destination by a certain known or assumed time, such as the relief of a port threatened by military operations; the junction with a force in a known position; the supply of a base, etc.

CASE (a).

(Sketch 17.)

A group of 4 Orange scouts in latitude 23° N., longitude 142° 55′ E., bound for the vicinity of GUAM as an observation force learns on 2 August at 5 P. M. that a Blue convoy sailed from APRA 1 August, 10 A. M. Maximum speed, 12 knots. This group is directed to search the direct route APRA–AMAMI.

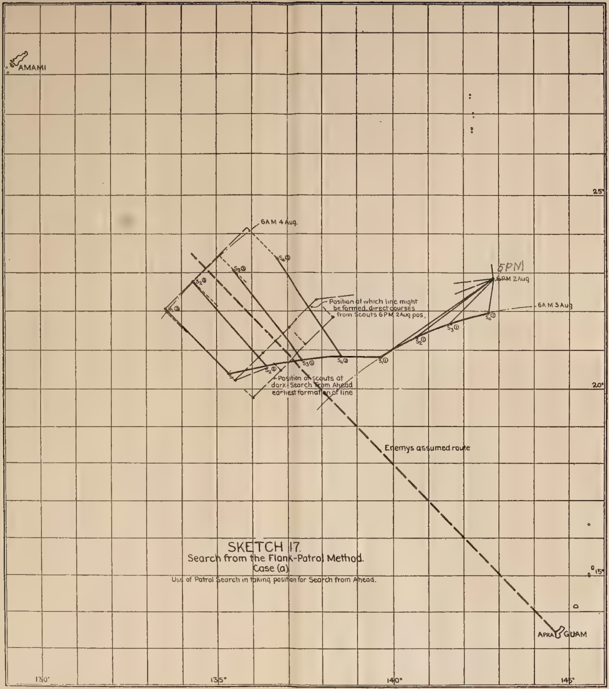
The scout commander finds his earliest meeting point with the enemy force is during darkness. The earliest time at which he can form a line for the use of the *search from ahead* is about 3 August, 4 P. M.

The scout commander decides to cover the area to northeastward of the direct course while taking position for the search from ahead, by running a patrol search on 3 August and, during the night of 3 August, retire to a position for using the search from ahead.

The scouts are accordingly formed on 3 August, 6 A. M., on the arc of the enemy's position circle, the western scout in a position as far west on the circle as it can steam during the night. The scouts are placed 60 miles apart. This distance could be greater, but such increase in distance would much delay the formation of the line for the *search from ahead* on 4 August.

At daylight the western scout starts the retiring search to the westward. The other scouts follow on chords of the arc, passing through all original positions between them and the "point of origin"; after reaching the "point of origin," they follow on the search curve.

On 3 August, at dark, the scouts retire to form a line for the use of the *search from ahead.* The northern scouts can not reach the desired positions by daylight, but, as they have retired at more than 12 knots, the enemy's assumed maximum speed, they feel sure the enemy has not passed them. They take up positions on the proper lines and wait until the time at which they should be in that position; they then move to the front at the assigned scouting speed for the day.



SKETCH 17.
Search from the Flank-Patrol Method.
Case (a).
Use of Patrol Search in taking position for Search from Ahead.

CASE (b).

(Sketch 18.)

SEARCH METHOD EXERCISE 4.

SEARCH FROM THE FLANK—PATROL METHOD.

Motives.—Exercise in the conduct of search operations.

Patrol method.

Use of limiting ellipse.

General situation.—War exists between Orange and Blue. Blue has established an advance base at AMAMI O SIMA. After an indecisive though severe engagement off SIMONOSEKI, the Orange fleet retired into the INLAND SEA. The Blue fleet retired to AMAMI.

On 27 March the Orange Navy Department learned that a Blue expeditionary force of 10,000 troops in 10 transports escorted by 6 armored cruisers of the CALIFORNIA class and a squadron of second-class cruisers had been assembled at APRA. It has been rumored that Blue intends seizing PORT LLOYD in the BONIN ISLANDS. An Orange advance base detachment of sufficient strength to hold PORT LLOYD was directed to occupy that port.

A raiding force consisting of 4 battle cruisers at KURE and 4 second-class cruisers at PORT LLOYD was directed to intercept and destroy the Blue convoy.

Special situation.—On 30 March, at noon, the raiding force commander receives the following radio message:

ORANGE NAVY DEPARTMENT,
TOKIO,
MARCH 30, 10 A. M.

Blue convoy of ten transports with ten thousand troops sailed from APRA, thirty March, five-thirty A. M. Our advance base detachment will secure PORT LLOYD by two April, noon.

Operate to destroy Blue convoy, guarding PORT LLOYD until assured of its defense by advance base detachment.

O. O. O.

At the time this message is received, the raiding force is disposed as follows:

Battle cruisers in Lat. 22°, Long. 143°.

Second-class cruisers on scouting line, 270°.

F–1, western ship, in Lat. 19°, Long. 144°.

Distance, 60 miles.

Course, 180°.

Speed, 15 knots.

Required.—Plan of search for 31 March and 1 April under following assumptions:

Only the 4 second-class cruisers to be used in the search.

Search to be conducted by Patrol Method.
Maximum sustained speed of second-class cruisers is 18 knots.
Maximum assumed speed of Blue transports is 12 knots.
Daylight 5.30 A. M. to 6.30 P. M.
Time required for radio messages, one-half hour.

PATROL METHOD.

SOLUTION.

(Sketch 18.)

From the disposition of the scout division at the time the information of Blue's departure is received, it is evident that no daylight contact can be made with the Blue force earlier than daylight 31 March. The scouts should be placed on the enemy's daylight circle, using as Blue's speed his assumed maximum, 12 knots.

Orange's instructions require him to guard PORT LLOYD until assured of its defense by the advance base detachment, which force, it is assumed, will secure PORT LLOYD by 2 April, noon. The Orange scouts must, therefore, search the area from which Blue can arrive at PORT LLOYD before 2 April, noon. After this area is exhausted, the search may be continued to the westward.

From the time of Blue's departure from APRA, 30 March, 5.30 A. M., until 2 April, noon, is 78½ hours and, at 12 knots, Blue could steam 942 miles during this time.

An ellipse with a major axis of 942 miles and focii at APRA and PORT LLOYD will indicate the limits within which Blue must move to threaten PORT LLOYD.

This ellipse is constructed on the chart as follows:

Compute the distance the Blue force can steam at its maximum speed between the time of its departure from APRA and the time at which the advance base detachment will have secured PORT LLOYD.

In this case 78½ hours×12 knots=942 miles.

Lay off this distance on the chart, using the scale for the middle latitude.

Put two pins in a string at such distance apart that when the string is taut between the pins, one pin is at each end of this line.

Place the pins, one at the enemy's point of departure and one at the point to be guarded. The string will now be slack. Place a pencil point inside the string and move to one side until the string is taut. Now move the pencil to all positions that can be reached with the string taut. The line described by the pencil point will be an ellipse.

This ellipse is called the "limiting ellipse," for it describes the limits of the area in which the Blue can move and arrive at PORT

LLOYD by the time the advance base detachment has secured the base.

At 31 March, 5.30 A. M., Blue can not be more than $24\times12=288$ miles from APRA. This limit is the daylight position circle described with APRA as a center and 288 miles as a radius. This circle can be reached by all scouts by daylight 31 March.

In order to threaten PORT LLOYD, Blue's distance from PORT LLOYD at this time must not exceed $(78\frac{1}{2}-24)\ 12=54\frac{1}{2}\times12=654$ miles. A circle described with PORT LLOYD as center and 654 miles as a radius will indicate this limiting distance.

The intersection of these two circles forms a lune-shaped area within which Blue must lie at daylight, 31 March, if he is in position to threaten PORT LLOYD.

The patrol method has been directed. The principal points to be considered in forming the line are:

(1) The scouting distance.

(2) The position of the eastern scout.

The distance, which may efficiently separate scouts placed upon the daylight circle, is given by the formula $d=r+\left(r\times\frac{S}{s}\right)$ where d=distance, r=range of visibility of the smoke of the force searched for, s=the speed of the force searched for, and S=speed of the scouts. Applying this formula we have:

$$\text{Distance}=30+\left(30\times\frac{18}{12}\right)\cancel{18}=30+45=75 \text{ miles.}$$

To find the position of the eastern scout two points must be considered:

(1) The scout must be as far east as the intersection of the limiting ellipse with the Blue maximum-speed position circle.

(2) The eastern scout must be so far to the eastward that Blue can not, during the movement of this scout to the westward, pass to the eastward of the circle of visibility of this scout and arrive at PORT LLOYD before 2 April, noon.

If with PORT LLOYD as a center, arcs are swung cutting the Blue daylight curve, upon which the scouts are to be formed, with radii equal to Blue's limiting distance from PORT LLOYD at the end of each $3\frac{1}{4}$-hour period, we locate the most easterly position that Blue can occupy along the daylight curve at the corresponding time and be in position to threaten PORT LLOYD.

If *F–4*, the eastern scout, while moving to the westward along the circle should move too fast, it would be possible for the Blue force to arrive at position B at 8.45 A. M., or at point C at noon, and changing course for PORT LLOYD, at maximum speed, Blue could arrive by the time PORT LLOYD is secured.

F–4 must, then, be so placed that point A is visible at daylight and must move to the westward only such distance that the visibility distance covered to the rear, extends beyond any point which Blue could occupy at the time, and arrive at PORT LLOYD by 2 April, noon.

The points of intersection of the limiting circles from PORT LLOYD with the position circle upon which the scouts are formed, moves from A to B in $3\frac{1}{4}$ hours, a distance of 50 miles. From B to C in $3\frac{1}{4}$ hours, a distance of 57 miles. From C to D in $3\frac{1}{4}$ hours, a distance of 113 miles.

58.5

The scout *F–4* moves in $3\frac{1}{4}$ hours ~~65~~ miles.

The visability distance covered to the rear is, at daylight, but 30 miles, but after the search has been in progress for about an hour the distance covered to the rear is $r \times \frac{S}{s}$, in this case $\frac{30 \times \cancel{20}}{12} = \cancel{50}$ miles. 75

If, then, at 8.45 A. M. and at noon, the scout *F–4* is not more than ~~50~~ miles to the westward of the points B and C, respectively, the search will be efficient. As the scout is to move at ~~20~~ knots, its position at daylight must be such that it will not be to the westward of these intersections more than ~~50~~ miles at the time corresponding to the intersection. 45

In this problem there is no particular advantage in disposing the line of scouts as far as possible to the westward. The factor of safety has been taken to the eastward; that is, it has been assumed that the position of the eastern scout should be such as to exactly correspond with point C at noon (this is the point at which the movement of the intersection becomes more rapid than the movement of the scout), the original position for *F–4* would, therefore, be ~~130~~ miles ($3\frac{1}{4} \times 2 \times \cancel{20}$) to the eastward of point C along the circle. 117

The area within which Blue is dangerous and within which he may lie undetected is, at dark, inclosed between the limiting circles for 6.30 P. M. from APRA and PORT LLOYD and the line of scouts from *F–1* to *F–4*.

The scouting line must be retired during the night to cover any movement of Blue from this area toward the BONIN ISLANDS, and *F–1* must occupy a position on the Blue maximum-speed position curve for daylight 1 April.

Sketch 18 shows the method of search, the retirement during the night, and the search operation for 1 April.

At daylight 1 April the line has been re-formed in such a position that an enemy force to the southward of the line of scouts at dark 31 March can not, at 12 knots, be to the northward of the line of scouts at daylight 1 April.

The search is continued to the westward, on the assumption that Blue is bound for some port farther west, the areas from which Blue could threaten PORT LLOYD having been exhausted by the scouts.

METHOD OF FORMING THE LINE

IN ORDER TO INCREASE DISTANCE AT WHICH SCOUTS MAY BE EFFECTIVE.

In some instances where the area to be searched is large and the number of scouts small, it may be desirable to use a distance between scouts greater than that given by the formula

$$r+r\times\frac{S}{s}=d.$$

In the examination of the distance that could be covered by the scouts when formed on a position circle, it was found that in practice this formula assumes that each scout covered a distance r to the rear and a distance $r\times\frac{S}{s}$ ahead of it.

It can be shown that after the scouts have been under way on the scouting line more than a short time interval, they would be effective at a distance $2r\times\frac{S}{s}$.

How can the line be formed to take advantage of this maximum distance?

Let AB = this maximum distance. $2r\times\frac{S}{s}=\overset{60}{\cancel{16}}\times\frac{20}{15}=80$ miles. A scout at A can cover 30 miles to the rear. The line must be so formed that scout *B* can cover 50 miles ahead.

$$\overset{\text{30 miles.}}{A\text{———————————}}x\overset{\text{50 miles.}}{\text{————————————————}B.}$$

$AB=2r\times\frac{S}{s}=60\times\frac{20}{15}=80$ miles. $80-30=50$.

The scout moves 50 miles in $\frac{50}{20}=2\frac{1}{2}$ hours.

In $2\frac{1}{2}$ hours the enemy can move $2.5\times15=37.5$ miles. The line of scouts must be formed outside of the enemy position circle $37.5-r=37.5-30.0=7.5$ miles.

In view of the increased distance at which the scouts are operating, the search becomes ineffective one-half hour $\left(\frac{7.5\text{ mi.}}{15\text{ mi}}\right)$ before dark. That is, the search should be continued until dark, but in retiring the line for the night, it should be retired on the assumption that the enemy might have passed the line undetected one-half hour before dark.

The chance that the enemy could pass the line undetected in the half-hour before dark is, in this case, as 1 is to 8.

In running the retiring search curve, when the line is so formed, the leader steams for the point on the enemy's position circle for the

In $\frac{q}{s}$ hours A has gone from P to A. $\therefore \frac{\quad}{S} = \frac{q}{s}$

$$AP = OA - r. \qquad OA = \frac{rS}{s} \therefore \frac{q}{s} = \frac{\frac{rS}{s} - r}{S}; \quad \frac{q}{s} = \frac{r}{s} - \frac{r}{S}; \ \frac{q}{r} = 1 - \frac{s}{S}.$$

Applying this to the case on p. 120, substituting r = 30, s = 15, S = 20, we get q = $7\frac{1}{2}$. This is 1/8 of the diameter MN and thus gives enemy 1 chance in 8 to get by.

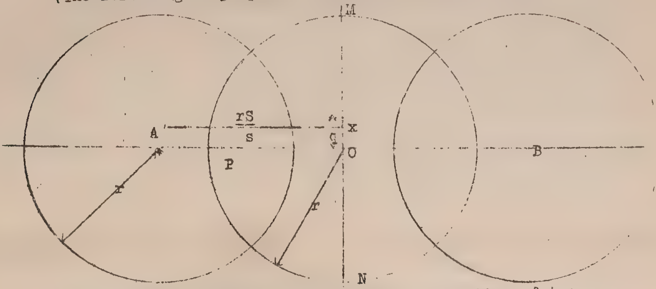
(WWP/WHF 3Jul'19)

THE SERVICE OF INFORMATION AND SECURITY (1916)

Addenda to Chapter XI.

Insert following page 120.

(The following is prepared by Commander G.J.Rowcliff).



Take the above diagram as indicating the position of two adjacent scouts A and B, at sunset. Enemy's course is along M N and he is somewhere between M and N.

If he is between O and N he cannot get by, as the line will retire at his speed during the night and keep in advance of him.

If enemy were at M he would have been seen by A. If he were just above O he would not be seen by A or B, and would get by. There must be some point X at which he would just escape detection by A. This point must be in such a position that, when enemy was at O, he was just on the visibility circle of A, or A was at P.

Let OX = q. The enemy's time from O to X is $\frac{q}{s}$ hours. In $\frac{q}{s}$ hours A has gone from P to A. $\therefore \frac{AP}{S} = \frac{q}{s}$

$AP = OA - r.$ $OA = \frac{rS}{s}$ $\therefore \frac{q}{s} = \frac{\frac{rS}{s} - r}{S}$; $\frac{q}{s} = \frac{r}{s} - \frac{r}{S}$; $\frac{q}{r} = 1 - \frac{s}{S}$.

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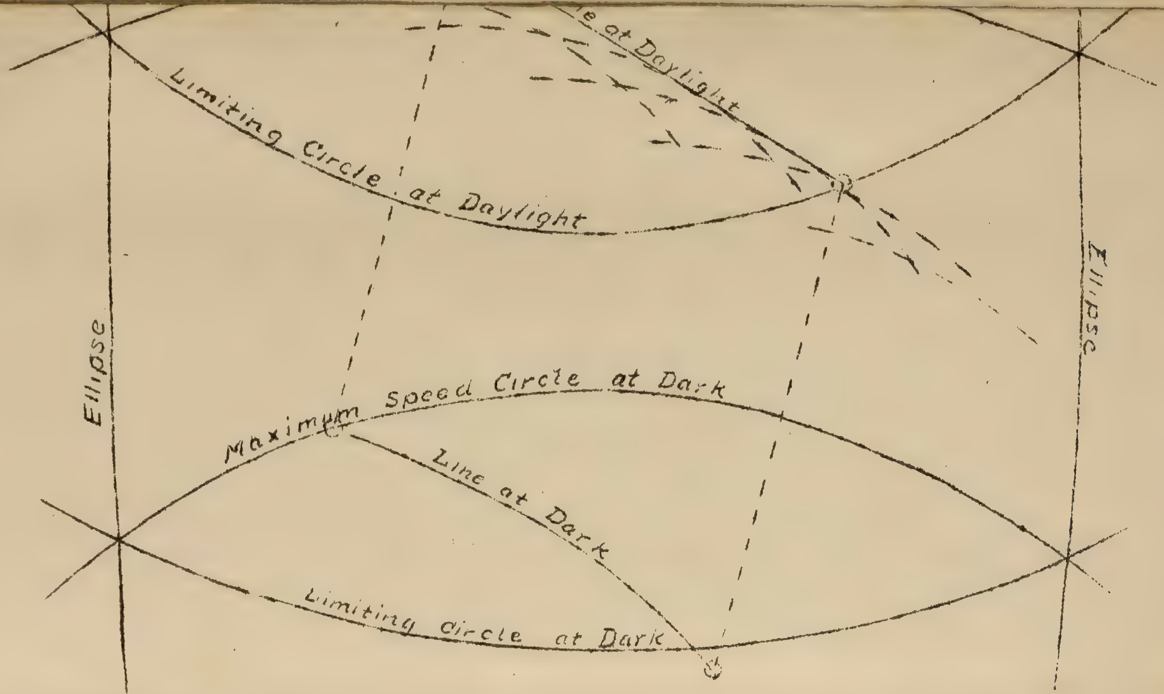
(WJP/WHF 3Jul'19)



e at Daylight
Limiting Circle at Daylight
Ellipse
Ellipse
Maximum Speed Circle at Dark
Line at Dark
Limiting Circle at Dark

(To accompany Sketch 18, page 120 -- "The Service of Information and Security", by Lieutenant Commander W.S.Pye, U.S.Navy.)

(384 WE-FV-13 Jun'19
54 Restencilled.)

RETIRING SEARCH PATROL.

RETIREMENT OF LINE DURING DARKNESS.

GIVEN: Position of scouting line at dark in lune-shaped area with one end on enemy maximum speed circle.

REQUIRED: To retire line to occupy similar position in daylight lune without losing any advantage thereby.

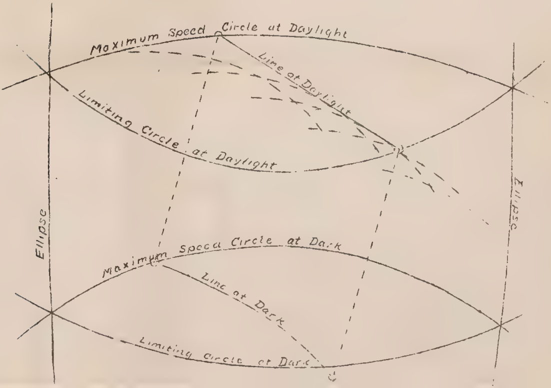
CONDITIONS TO BE FULFILLED: At daylight.

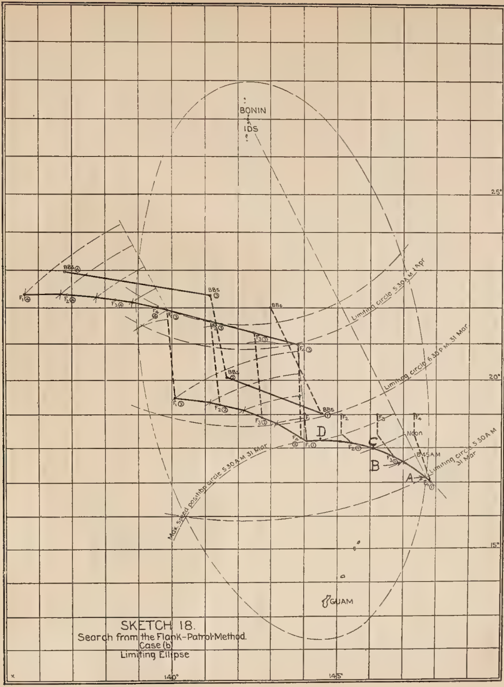
(1) One end scout should be on enemy maximum speed circle for daylight.
(2) The other end scout must be on enemy limiting circle for daylight and as far to the flank as may be necessary to cover any position that the enemy might occupy.
(3) No point on the morning line should be less than the night's run of the enemy from any point on the previous evening line.

METHOD OF LOCATING LINE:

(1) With maximum enemy run during dark as a radius strike arcs in direction of retirement from all points on scouting line at dark.
(2) With straight-edge equal in length to the length of the scouting line, place one end on the enemy daylight limiting circle outside all intersections of the arcs with that circle. Then bring the straight-edge tangent to, or outside of, arcs marking position for other end of line on enemy maximum speed circle for daylight. The two points, thus found, locate the ends of the scouting line at daylight.

NOTES: The daylight line should preferably be a straight line.
The location of the line and the positions of the scouts on that line should be fixed by a campaign order issued the previous evening.
There is no objection to shortening the scouting line for daylight if the above conditions can be covered.





SKETCH 18.
Search from the Flank-Patrol-Method.
Case (b)
Limiting Ellipse

end of the first period, not for a position on a circle outside of the position circle. During this first period, the scout increases his distance from the enemy's point of departure by an amount equal to the length of the period multiplied by the enemy's assumed maximum speed minus the distance the line was formed outside of the position circle.

It is not desirable to use this maximum distance if the area can be covered at less distance. The radius of visibility may be reduced due to haze or rain; some one scout may break down; in fact, the chances of failure are great.

The greatest concentration of scouts consistent with covering the required area is always advisable.

CHAPTER XII.

QUESTIONS AND ANSWERS—SEARCH FROM THE FLANK.

PATROL METHOD.

CHAPTER XII.

QUESTIONS AND ANSWERS—SEARCH FROM THE FLANK.

PATROL METHOD.

(*Sketch 19.*)

Question 1. How is the line formed when using this method?

Answer. The line should be formed toward one flank of the area to be searched, and the retiring search curve run toward the other flank.

The line should be formed during, or at daylight, on or outside the first position line or position circle in the desired area, on which all scouts can reach their assigned positions.

If formed on the position line or circle, the distance between scouts should not exceed the distance obtained by the formula $r+r\times\frac{S}{s}=\text{distance}$, where r = radius of visibility in miles; s = maximum speed of force searched for, in knots; S = scouting speed of scouts, in knots.

This distance between scouts may be slightly increased by forming the scouting line outside of the enemy's position line or circle.

The maximum effective distance, when so formed, is given by the formula:

$$2r\times\frac{S}{s}=d.$$

In this case the scouting line must be formed outside of the position line or circle a distance equal to

$$\frac{2r\times\frac{S}{s}-r}{S}\times s-r=a.$$

Assuming values: S=20, s=15, r=30, this distance is

$$\frac{60\times\frac{20}{15}-30}{20}\times 15-30=a.$$

$$\frac{80-30}{20}\times 15-30=a.$$

$$\frac{50}{20}\times 15-30=a.$$

37.5—30=7.5 miles outside.

If the scouting line is formed outside of the position line or circle, the retirement of the scouts must be reckoned from the possible time at which the enemy could cross the scouting line unobserved, which is: $\frac{a}{s}$ hours before dark, where a=distance in miles the scouting line was formed outside, and s=the maximum speed of the enemy.

In the above case, a=7.5; s=15.

$$\frac{a}{s}=\frac{7.5}{15}=\tfrac{1}{2}\text{ hour.}$$

The search is continued until dark, but the retirement is made on the assumption that the enemy may have crossed the line one-half hour before the retirement was begun.

The first course of the leader is toward a meeting point with the enemy at the end of the first period. As the scout started the search 7.5 miles outside the position circle, the component of his course and speed resolved along the radius should be 7.5 miles less than the movement of the enemy in the same period.

At the end of the first period the scout is on the correct position circle and his course from this time follows the search curve.

Question 2. What is the maximum distance at which scouts should be placed under each condition, (a) on the position circle, (b) outside the position circle, the assumptions being as follows:

Speed of scouts, 22 knots.

Assumed enemy maximum speed, 13 knots.

Assumed range of visibility of force searched for, 25 miles?

Answer. (a) On the enemy's position line or position circle:

$$r+r\times\frac{S}{s}=25+25\times\frac{22}{13}=25+42=67\text{ mile.}$$

(*b*) Outside the position circle:

$$2r\times\frac{S}{s}=50\times\frac{22}{13}=84\text{ miles.}$$

If formed outside the enemy's position line or circle, it should be formed:

$$\frac{84-25}{22}\times13-25=35-25=10\text{ miles outside.}$$

Question 3. Having learned that a large Blue convoy left APRA 1 August, 10 P. M., maximum assumed speed 12 knots, 4 Orange scouts at COFFIN BAY sail on 2 August, 4 A. M., to search for Blue.

The scout commander decides:

To form on the enemy maximum speed daylight position circle on 3 August, 6 A. M., as far as possible to the westward;

To space the scouts at the maximum effective distance for this position, assuming radius of visibility as 30 miles;

To run the retiring search to westward;

To change course three times during daylight, 6 A. M. to 6 P. M.;

To use 20 knots at the scouting speed.

What would be the path of the 4 scouts for 3 August, 6 A. M. to 6 P. M.? Indicate daylight and dark positions of each scout.

Answer. Blue left APRA on 1 August, 10 P. M., assumed maximum speed 12 knots. He will have steamed 32 hours at 12 knots or 384 miles by 3 August, 6 A. M.

Blue's position circle for 3 August, 6 A. M., is one having its center at APRA and a radius of 384 miles.

The Orange scouts left COFFIN BAY on 2 August, 4 A. M. In 26 hours at 20 knots, each scout could steam 520 miles. The most westerly position on Blue's daylight circle for 3 August, which would be reached by any scout, would be at the intersection of the Blue daylight circle with a circle, center at COFFIN BAY and radius 520 miles.

This point is in Lat. 18° 03′ N., Long. 140° 07′ E.

The scouts are to be separated by their maximum effective distance on the position circle—

$$d = r + r \times \frac{S}{s} = 30 + 30 \times \frac{20}{12} = 30 + 50 = 80 \text{ miles.}$$

The path of the western scout is a retiring search curve from his original position to the westward, scouting speed 20 knots, enemy's assumed speed 12 knots.

The other scouts pass through original scouting positions to westward and, when the point of origin is reached, follow on the search curve.

Path shown in Sketch 19.

Question 4. What, in degrees, is the angle searched on 3 August for enemy's speed 12 knots?

Answer. As the scouts are formed on the enemy 12-knot position circle, the eastern limit is a radius tangent to the visibility circle of the eastern scout at daylight.

The western limit is the radius tangent to the visibility circle of the western scout at dark.

In this case, the angle searched for enemy speed 12 knots is 70°.

Question 5. What, in degrees, is the angle searched on 3 August for enemy speed 11 knots?

Answer. The position circle upon which the scouts were formed was distant from APRA 384 miles. At 11 knots, the enemy could reach this circle in $\frac{384}{11}=35$ hours, approximately, or 3 August at 9 A. M.

In 3 hours the eastern scout would have steamed 60 miles along the Blue position circle to the westward, but in so doing it has covered for enemy speed, 11 knots, a visibility distance behind it, equal to

$$r\times\frac{S}{s}=30\times\frac{20}{11}=54.5 \text{ miles}$$

The eastern radius of the sector searched for enemy speed, 11 knots, is one passing 54.5 miles to the eastward along the position circle of the eastern scout's position at 9 A. M.

To obtain the western radius of this sector, draw the 11-knot position circle for dark 3 August, 6 P. M. (a circle of radius, 484 miles), then draw the visibility circle of the scout whose 6 P. M. position is nearest to the point of intersection of the 11-knot position circle, with the path of the scouts. A radius from the enemy's point of departure through the point of intersection of this visibility circle with the 11-knot position circle is the western limit of the 11-knot sector searched. If no visibility circle from a scout's position at dark cuts the position circle, the limit is the intersection of this circle with the path of the scouts. In this case the angle searched is $58\frac{1}{2}°$.

Question 6. Assuming the search conducted as in the sketch, what, in degrees, is the angle covered for enemy speed 12 knots, but actual time of departure from APRA, 2 August, 2 A. M.?

Answer. If Blue left APRA, 2 August, 2 A. M., he would not arrive at the position circle upon which the scouts were formed until 3 August, 10 A. M. At that time the eastern scout has moved 80 miles to the westward, but has covered a visibility distance $r\times\frac{S}{s}=30\times\frac{20}{\cancel{22}}=50$ miles to the eastward on this line.

The eastern radius of the sector searched for this assumption passes through a point on the circle 50 miles east of the position of the eastern scout at 10 A. M.

The western radius is obtained as for the western radius of the 11-knot assumption.

The position circle for 6 P. M., assuming a departure of 2 August, 2 A. M., will be 48 miles nearer APRA than the original dark circle, or the same as the position circle drawn for 2 P. M., under the original assumptions.

This is practically identical with the western radius for the 11-knot assumption.

The angle searched is 54°.

Question 7. What would be the position of the scouts on 4 August, 6 A. M., daylight, if the assumed destination of the enemy was AMAMI?

Answer. The line would be retired in the general direction of the enemy's assumed destination. The usual course is that from the dark position of a scout at the end of the line to the enemy's assumed destination. All scouts retire at a uniform speed and on parallel courses to maintain their distance.

In Sketch 19, the retirement has been made with the western scout as guide, on a course from this scout's dark position toward AMAMI.

In making this retirement, the western ship must at daylight 4 August occupy a position on Blue's 12-knot position circle.

In order to reach this position circle on a course to AMAMI, it will be necessary for the scout to use a higher speed than the enemy's assumed maximum. Position marked Question 7, in the Sketch.

When, as in this case, the speed of the leader must be much higher than the enemy's maximum in order that he may gain his position on the proper daylight circle, it may be advantageous to re-form the line by a different method, as follows:

From the position of the eastern scout at dark, draw an arc of a circle with a radius equal to the distance the enemy could steam during the night at his maximum speed. Draw the arc of a circle from the new daylight position of the leader with a radius equal to $n-1 \times d$, where n = number of scouts, d = effective scouting distance when formed on the position circle.

The new scouting line is the radius of this arc intersecting the arc of the first circle drawn. In Sketch 19, this is marked "Question 7 (a)."

This formation of the line is more efficient for reduced speeds of the enemy, but makes concentration more difficult if the enemy is encountered by the leader, as some of the scouts are in positions nearer to the enemy's point of departure and, consequently, farther from the enemy when discovered.

Question 8. What would be the position of the scouts on 4 August, 6 A. M., daylight, if the assumed destination of the enemy was POLILLO?

Answer. If the assumed destination was POLILLO, the retirement would probably be made along the radius from enemy's point of departure, passing through the dark position of the leader, for the scouts have sufficient time to search all the area to northward of the direct route APRA–POLILLO before Blue could reach POLILLO.

In this case the leader would retire on the radius from the enemy's point of departure, passing through his own dark position at a speed equal to the enemy's assumed maximum, in this case 12 knots. The other scouts retire on a parallel course to that of the leader and at the same speed.

A retirement toward POLILLO during the night would cause all of the scouts to steam almost on the direct course for POLILLO. There would be danger of the enemy passing through the line of scouts unobserved during darkness, if, as is possible, he is steering a course slightly more to the northward.

Question 9. Assuming this Blue convoy to have left APRA, 1 August, 10 P. M., assumed maximum speed 12, draw the path for 12 hours' search for 4 scouts which sail from POLILLO on 2 August, 6 P. M. Daylight 6 A. M. to 6 P. M. Maximum sustained speed of the scouts being 20 knots, acting under the following instructions:

"Search to northward from direct course APRA–POLILLO, cover greatest sector for enemy's assumed maximum speed."

Answer. The distance APRA–POLILLO is 1,320 miles.

Blue sailed 1 August, 10 P. M., 20 hours ahead of the departure of Orange scouts from POLILLO.

At the time of scouts' departure Blue was distant from POLILLO 1,320—240=1,080 miles.

Scouts and Blue approach at the rate of 32 miles an hour. They will meet in $\frac{1080}{32}$ hours after scouts' departure=$33\frac{1}{4}$ hours. This would be during darkness, so the scouts steam at a speed sufficient to put them on Blue's daylight circle for 4 August, 6 A. M.

At the time, Blue would have steamed 56 hours at 12 knots=672 miles from APRA.

To obtain maximum distance for scouting use formula

$$2r \times \frac{S}{s} = 60 \times \frac{20}{\cancel{15}\ 12} = 100 \text{ miles.}$$

To do this the line must be formed outside the daylight circle a distance equal to

$$\frac{\left(2r \times \frac{S}{s} - r\right)}{S} \times s - r = \frac{100-30}{20} \times 12 - 30 = \frac{70}{20} \times 12 - 30 = 42 - 30 =$$
12 miles.

At daylight the course of the leader is toward a point on the enemy's position circle for the end of the first period, distant from the scout's daylight position the distance the scout can steam during this period. The search curve is continued as if the line had been formed on the position circle, but on account of the increased dis-

tance at which the scouts are spaced, the line may be ineffective after 5 P. M.

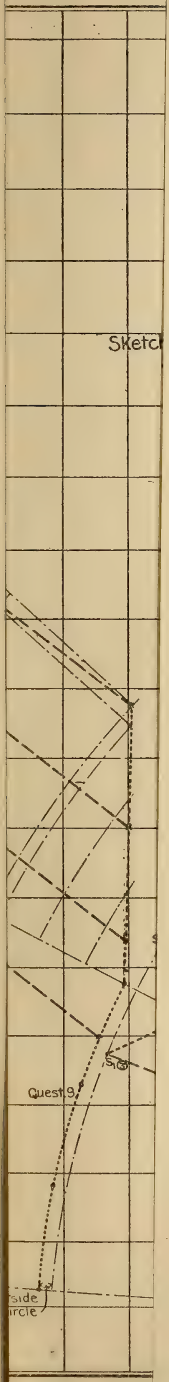
The search is continued until dark, because of the possibility of locating the enemy, but when the retirement is made it must be made under the assumption that the line has not been efficiently covered since 5 P. M.

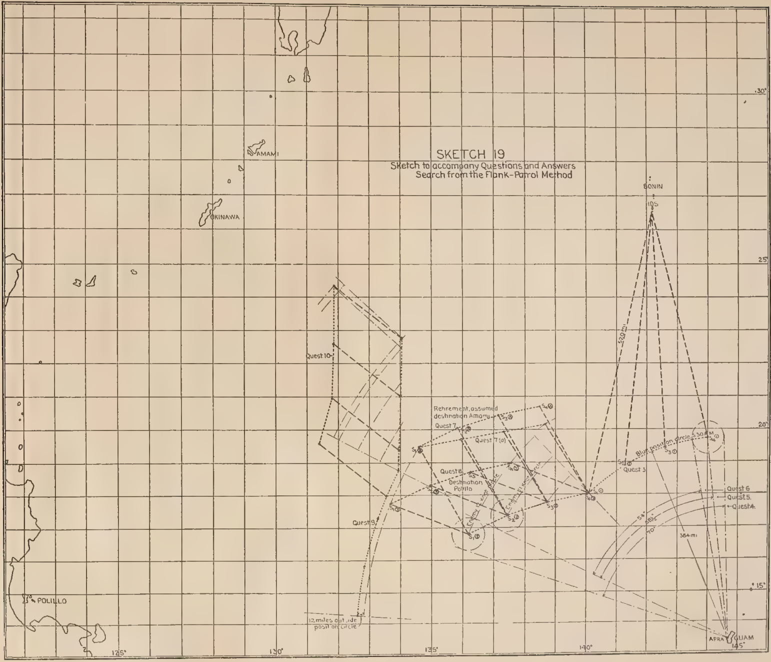
The course and speed for this retirement is such as to bring the leader at daylight on a position circle 12 miles outside of the Blue daylight position circle, at the intersection with the radius from the enemy's point of departure passing through the leader's 5 P. M. position.

The other scouts retire on courses parallel to the leader at the same speed.

Question 10. What would be the position of the line the following daylight, the scouts having retired on a radius from the enemy's point of departure, passing through the leader's 5 P. M. position?

Answer. The retirement and position of the line is shown in Sketch 19.


Quest 9



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CHAPTER XIII.

SEARCH FROM THE REAR.
TRAILING METHOD.

CHAPTER XIII.

SEARCH FROM THE REAR.

TRAILING METHOD.

Trailing is the general name applied to all forms of searching from the rear.

The standard form is similar in most respects to the search from ahead with the exception that the line is formed in rear of the enemy; that is, between the enemy and his point of departure.

HOW TO FORM THE LINE.

The line is usually formed normal to the assumed course of the enemy at distance not exceeding twice the range of visibility of the force searched for.

The scouts steam on the same course, which is usually the assumed course of the enemy, at the maximum sustained speed of the searching force during daylight, and at the minimum assumed enemy speed during dark or other unfavorable visibility conditions. This night speed is sometimes modified as will be explained later.

WHERE AND WHEN TO FORM THE SCOUTING LINE.

The line must be formed during daylight between the enemy and his point of departure. Before a decision can be reached as to where and when this can be done, the following must be known or assumed:

1. The enemy's—

(a) Point of departure.

(b) Earliest time of departure.

(c) Probable destination.

(d) The general direction of movement from his point of departure, or general direction of movement during his approach to his destination.

(e) Maximum and minimum speeds.

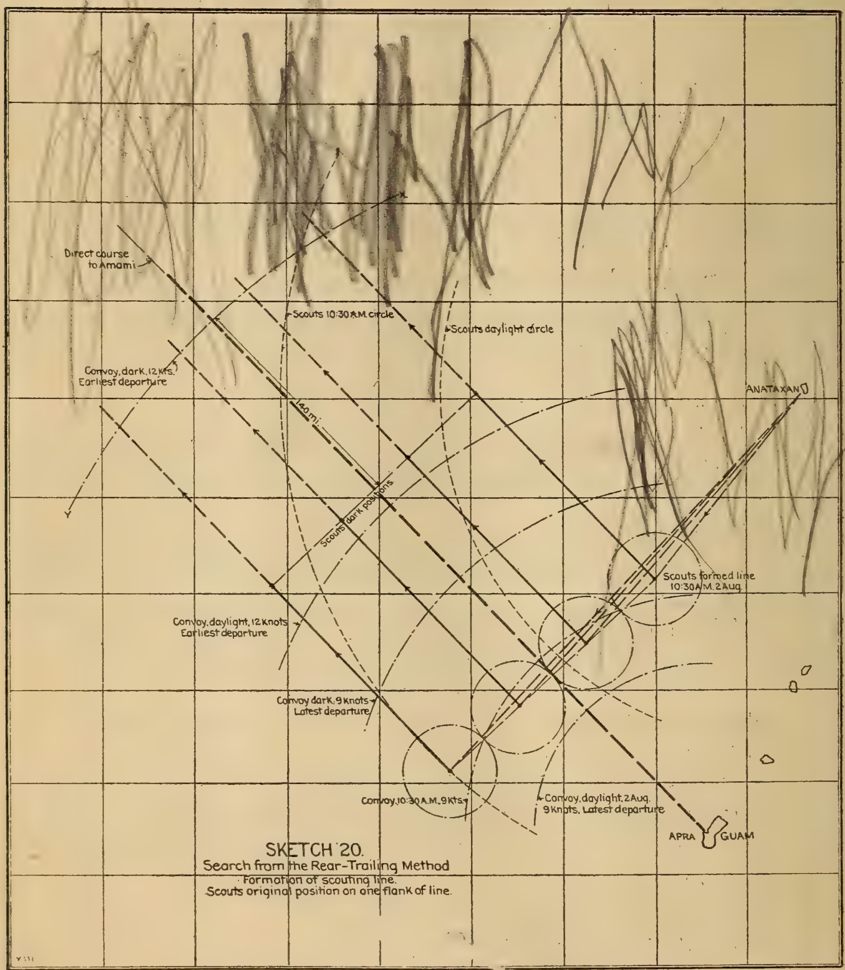
2. The scouts'—

(a) Point of departure.

(b) Maximum sustained speed.

(c) Condition as regards fuel endurance and supply.

Having answered these questions exactly, or else made assumptions, draw roughly on the chart position circles from the enemy's point of departure for his earliest assumed hour of departure and his maximum assumed speed, also for his latest assumed hour of departure and his assumed minimum speed.



SKETCH 20.
Search from the Rear-Trailing Method
Formation of scouting line.
Scouts original position on one flank of line.

Draw also simultaneous "position circles" for the scouting force, for its earliest hour of departure and its maximum sustained speed.

The arc between intersections of simultaneous "position circles" of the scouting force, maximum speed, and enemy force, latest hour of departure and minimum speed, gives the limiting positions for the scouting line.

Example—Sketch 20.—Four Orange scouts at ANATAXAN ISLAND, learn in time to leave at dark, 1 August, 6.30 P. M., that a

Blue convoy left APRA 1 August, between 5.30 A. M. and 5.30 P. M. Assumed maximum speed of convoy, 12 knots.

The scout commander is directed to search by the trailing method.

He decides to form his line normal to the direct course to AMAMI, assuming the convoy minimum speed as 9 knots.

He draws the position circles for the convoy for daylight and dark 2 ~~3~~ August, and his own maximum speed position circle for daylight 2 ~~3~~ August.

He finds he can not get a scout 90 miles to westward of the direct route to AMAMI until 10.30 A. M. The line must be formed in such a position, normal to the assumed course, that all points between the scouts, on the enemy's assumed minimum speed position circle for 10.30 A. M., are in sight.

On account of the rapid curvature of the position circle, this curve can not be sighted by all scouts from a line tangent to the position circle. The line must be formed slightly nearer to the point of departure than such tangent in order to be sure that all points of the enemy's position circle between scouts are in sight from some one of the scouts.

To locate the exact position of the scouting line, draw a line parallel to the course to AMAMI and distant from the direct route 60 miles. Where this line intersects the enemy's position circle for 10.30 A. M. is one point on the line. See Diagram 6.

The line drawn parallel to the direct course and 60 miles from it represents the path of the point of tangency of the visibility circles of the two adjacent scouts. In order that all points of the position circle may be in sight, this point of tangency must lie on the enemy's position circle at the time the line is formed.

CONDUCT OF THE SEARCH.

(Sketch 20.)

At 10.30 A. M. the scouts would change course for AMAMI and take up maximum sustained speed, which is assumed to be 20 knots.

From 10.30 A. M. until 6.30 P. M. the scouts would steam at this speed.

At 6.30 P. M. the speed must be reduced to prevent a possibility of passing the enemy during the night.

As has been stated the assumed minimum speed of the convoy is 9 knots. It is possible that the enemy has used a maximum speed during the day and at night reduced his speed.

To be certain that all the area is covered for speeds between 9 and 12 knots, it is necessary to reduce the scouts' speed to 9 knots at dark.

What effect will this have on the search?

At dark the enemy might be on the position circle marked "xy." The position on this line most distant from the scouting line is at the intersection of this circle with the direct route to Amami.

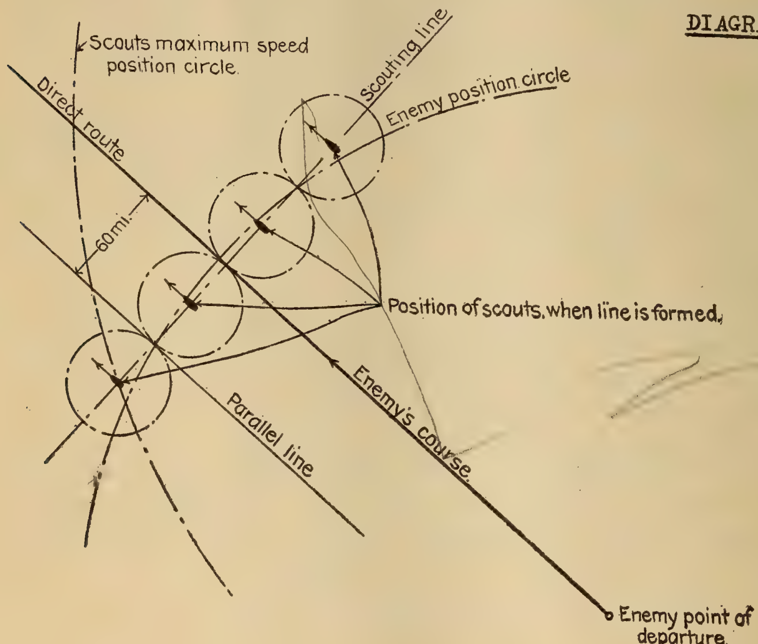
This distance at dark is about 140 miles.

If good weather conditions last the scouts will cover in 24 hours $13\times20+11\times9=359$ miles. The convoy at its maximum assumed speed can cover 288 miles.

The overhaul in 24 hours is 71 miles.

The convoy would be overhauled before it arrived close to AMAMI.

DIAGRAM 6.



UNFAVORABLE WEATHER CONDITIONS.

As in all other methods of search the procedure during unfavorable weather conditions is to take up the enemy's assumed speed and continue on the enemy's assumed course. In this case the speed would be the enemy's assumed minimum, and in the above example would be 9 knots.

The scout which first encounters unfavorable visibility conditions takes up the enemy assumed minimum speed and notifies the scout commander. The line is then reformed on this scout by reducing the speed of the others to steerage-way until the line is reformed.

From this it will be seen that much unfavorable weather will cause such a wide distance between the enemy's position for maxi-

mum speed for earliest hour of departure, and minimum speed for latest hour of departure, that the scouts might be unable to overtake the convoy when the weather cleared.

When the situation is such that using the above speeds the enemy could not be overtaken if he left at the earliest time of departure and steamed at his maximum speed, a higher speed than the enemy's assumed minimum must be used by the scouts during darkness or unfavorable visibility conditions.

At each dark, the scouts will have examined a certain distance from APRA. The area covered has been covered thoroughly, so at dark the convoy would have been sighted had it moved at an average speed less than this distance from APRA divided by the number of hours elapsed since earliest possible time of departure. The quotient so obtained is the highest average speed examined by the scouts, i. e.:

If at dark 3 August the scouting line is 679 miles from APRA, the highest average speed examined would be 679 divided by the number of hours elapsed since the convoy's earliest hour of departure, or $\frac{679}{61}=11.1$ knots.

Eleven and one-tenth knots should be the speed of the scouts for the night of 3 August.

The trailing method has the following advantages:

1. Is used from the rear, hence, smaller chance of scouts being detected. Disperses enemy force to the rear if it attempts to drive off scouts.

Disadvantages:

1. Must be based on recent accurate information.
2. High speed and great fuel consumption required.

CHAPTER XIV.

QUESTIONS AND ANSWERS—SEARCH FROM THE REAR.

TRAILING METHOD.

CHAPTER XIV.

SOLUTION OF EXERCISE IN TRAILING.

(Sketch 21.)

Question 1. What is the essential difference between the *search from ahead* and the *trailing* method?

Answer. In the search from ahead the scouting line is formed ahead of the enemy (i. e., between the enemy and his assumed destination), while in the trailing method, the scouting line is formed in rear of the enemy (i. e., between the enemy and his point of departure).

In the search from ahead the scouts, during favorable conditions, steam on a course parallel but opposite to the assumed course of the enemy, the forces thus approach at a rate equal to the sum of the speeds of the scouts and enemy force.

In the trailing method the scouts steam on the enemy's assumed course at their maximum sustained speed during favorable conditions, and at the enemy's assumed minimum speed or maximum speed for enemy's earliest hours of departure examined, during unfavorable conditions. The rate of approach of the scouts to the enemy is, during favorable conditions, equal to the difference between the scouts' maximum sustained speed and the speed of the enemy force.

Question 2. How should the line be formed?

Answer. The line should be formed at right angles, normal, to the assumed course of the enemy. Scouting distance not to exceed twice the assumed range of visibility of the force for which the search is being conducted.

Question 3. When and where should the line be formed?

Answer. The line should be formed at or during daylight, at such a distance in rear of the enemy's position circle for minimum assumed speed and latest hour of departure, that all of the arc of this circle between the scouts is covered, the distance between scouts not exceeding twice the range of visibility of the force searched for.

Question 4. What speed of the scouts is used during favorable visibility conditions?

Answer. The maximum sustained speed of the scouts.

Question 5. What speed of the scouts is used during darkness or other unfavorable visibility conditions?

Answer. The speed used by the scouts during darkness or other unfavorable visibility conditions is the assumed minimum speed of the enemy, or when such circumstances exist that it is necessary to use a higher speed to overtake the enemy, the highest average speed for enemy's earliest hour of departure which has been examined at the time the unfavorable conditions are encountered, if such is higher than the assumed minimum.

The highest average speed examined is obtained from the formula $V=\frac{D}{T}$, where V=highest average speed examined; D=distance of the center of scouting line from enemy's point of departure; T= hours elapsed since enemy's earliest assumed time of departure.

This formula gives the highest average speed examined for the assumed hour of enemy's departure.

If the enemy is assumed to be making a constant speed, it is known that he can not be making less than this average speed or he would have been discovered, if his course is such as to lie within the area which can be searched by this method with the scouts available.

This method will not assure the location of the enemy if his speed is not constant, for this average may have been obtained by using a maximum speed during daylight and a minimum during darkness.

Question 6. The center of a scouting line is 560 miles from the enemy's point of departure at dark, 3 August, 6.30 P. M. The information of the enemy was: Left point of departure 1 August between 5.30 A. M. and 6.30 P. M.

What is the highest average speed examined for enemy's earliest hour of departure?

What is the highest average speed examined for enemy's latest hour of departure?

Answer. $V=\frac{D}{T}$ $D=560$ $\left.\begin{array}{l}\text{1 Aug. 5.30 A. M.}\\ \text{3 Aug. 6.30 P. M.}\end{array}\right\}=61$ hours.

T for earliest hour of departure=61 hours.

$V=\frac{560}{61}=9.18$ knots, average speed examined for earliest hour of departure.

$V=\frac{D}{T}$ $D=560$ $\left.\begin{array}{l}\text{1 Aug. 6.30 P. M.}\\ \text{3 Aug. 6.30 P. M.}\end{array}\right\}=48$ hours.

T for latest hour of departure=48 hours.

$V=\frac{560}{48}=11.66$ knots, average speed examined for latest hour of departure.

Question 7. Four Orange scouts are in a position 60 miles east of APRA. A Blue convoy, the assumed destination of which is AMAMI, was reported in the harbor 1 August at 6.30 P. M.

On 2 August at 8 A. M. an aeroplane returns from a reconnoissance of APRA and reports the harbor empty.

The scout commander decides to trail the Blue force toward AMAMI, assuming Blue's earliest departure 1 August, 10 P. M.; latest hour of departure, 2 August, 3 A. M.

What is his procedure under the following assumptions:

One-half hour required for scouts to get under way.

Estimated maximum speed of enemy convoy, 12 knots; minimum, 9 knots.

Scouts maximum sustained speed, 20 knots.

Daylight, 5.30 A. M. to 6.30 P. M.?

Answer. Scouts sail from position 60 miles east of APRA at 8.30 A. M.

The scouts should search at 20 knots to the arc of a circle, center at APRA and middle point of the arc on the direct course APRA–AMAMI, scouts distance 60 miles.

The radius of this circle is limited by the position which can be reached by the western scout and in this case has a radius of 130 miles.

Question 8. Draw the paths of the scouts for 36 hours.

Answer. The scouts are at dark on a circle center at APRA, radius 130 miles.

The nemy's earliest hour of departure was assumed as 1 August, 10 P. M. It is now 2 August, 6.30 P. M. $T=20\frac{1}{2}$ hours. $D=130$ miles. $\frac{130}{20.5}=6+$knots. This average speed examined for enemy's earliest hour of departure is less than the enemy's assumed minimum speed, so 9 knots is used by the scouts during darkness.

The position of the scouts at daylight, 3 August, should be a straight line normal to the direct course from APRA to AMAMI.

The enemy may lie at any point on a position circle whose radius is $130+11\times9=130+99=229$ miles; the scouts must, therefore, be so disposed as to cover the arc of this circle at 60 miles distance and on a line normal to the direct course APRA–AMAMI. This line would be 221 miles from APRA on the direct route to AMAMI.

Question 9. At what time would the convoy be sighted had it sailed from APRA on the direct course for AMAMI at 12 knots, on 1 August at 10 P. M., assuming favorable visibility conditions and night-scouting speed of 9 knots?

Answer. On 4 August, 5.30 A. M., the convoy would be: $48+7.5=55.5$ hours at 12 knots$=666$ miles from APRA.

26051—16——10

The scouting line would be 221 miles, position 3 August, at 5.30 A. M.,+359 miles, distance moved in 24 hours—580 miles from APRA.

The convoy would be 666−580=86 miles ahead of the scouts. The convoy moving at 12 knots, the scouts at 20. The scouts gain 8 miles an hour and would overtake the convoy in $10\frac{3}{4}$ hours from 4 August, 5.30 A. M., or at about 4.15 P. M.

Question 10. What change in plan or speeds would be required if the convoy's assumed maximum speed was $12\frac{1}{2}$ knots instead of 12 knots, time of departure between 1 August, 10 P. M., and 2 August, 3 A. M.?

Answer. When the scouting line is formed on 3 August, 5.30 A. M., the convoy could be 393.7 miles from APRA. The center of the scouting line is but 221 miles from APRA. The convoy may be 172.7 miles ahead of the scouting line.

The convoy can steam, in 24 hours, 300 miles.

By the previous method, the scouts steam in 24 hours 359 miles.

The scouts could gain 59 miles in 24 hours.

It might require $\frac{172.7}{59}=2.9$ days to overtake the convoy.

In this case the convoy could arrive at AMAMI, as the scouts would not get the information in time to concentrate and attack.

It is therefore necessary for the scouts to use a higher scouting speed during the night by assuming a higher minimum or using, after the first night, the highest average enemy speed examined for earliest hour of departure.

By using highest average speed examined for enemy's earliest hour of departure for night scouting speed, the enemy would be overtaken on ~~5 August at 6.55 A. M.~~, thus assuring sufficient time for concentration and attack. 4 Aug 6.02 P m

SEARCH METHOD EXERCISE 5.

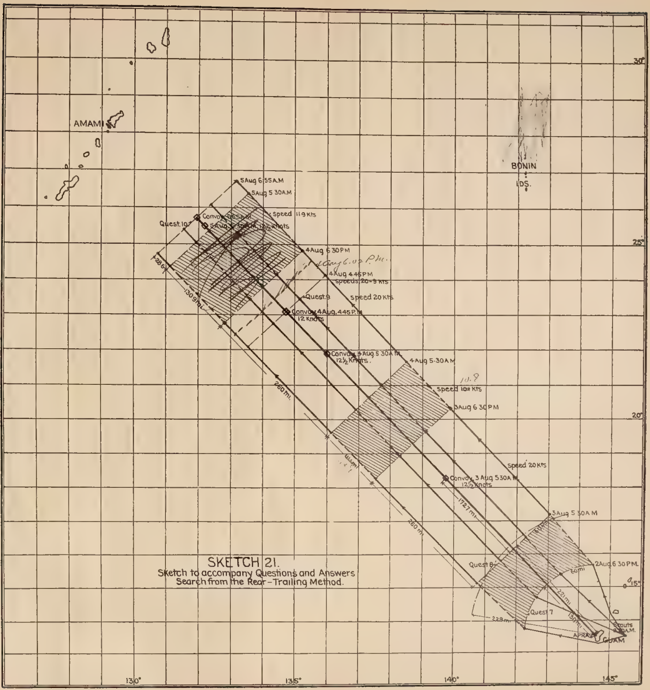
SEARCH FROM THE REAR—TRAILING METHOD.

Motives.—Exercise in the conduct of search operations, trailing method.

Study of the influence of fog on search operations.

General situation.—War exists between Orange and Blue. Blue has established an advance base at AMAMI O SIMA. After an indecisive though severe engagement off SIMONOSEKI the Orange fleet retired into the INLAND SEA. The Blue fleet retired to AMAMI.

On 29 March the Orange navy department learned that a Blue convoy was being assembled in APRA, GUAM, and that a division of armored cruisers and a squadron of second-class cruisers had been dispatched from AMAMI to act as an escort.


AMAMI
BONIN
IDS.
5 Aug 6 55 A.M
5 Aug 5 30 A.M
speed 11.9 Kts
Quest. 10
4 Aug 6 30 PM
4 Aug 4 45 PM
speed 20 Kts
Quest. 9
Convoy 4 Aug. 4 45 P.M
12 Knots
Convoy 3 Aug 5 30 A.M
12½ Knots.
4 Aug 5.30 A.M
speed 10.4 Kts
3 Aug 6 30 PM
260 mi.
speed 20 Kts
Convoy 3 Aug 5 30 A.M
12½ Knots
3 Aug 5 30 A M
2 Aug 6 30 P.M.
Quest 8
Quest 7
221 mi
60 mi
130 mi
APRA
GUAM
Scouts
130°
135°
140°
145°
30°
25°
20°
15°
SKETCH 21.
Sketch to accompany Questions and Answers
Search from the Rear-Trailing Method.

An Orange squadron of 6 armored cruisers at PORT LLOYD, BONIN ISLANDS, was directed to blockade or destroy the Blue convoy and escort.

Special situation.—On 1 April, 8 P. M., when the armored-cruiser squadron is about 180 miles north of APRA, steaming at 15 knots, a radio message is received from a tramp steamer off APRA, as follows:

Blue convoy at anchor in APRA at one April, six P. M.

At 2 April, 7.30 A. M., this armored-cruiser squadron arrives off APRA and finds the harbor empty.

Required.—A sketch of the tracks of the ships of this squadron from 2 April, 7.30 A. M., until 5 April, 6.30 P. M., with a note of each change of speed and reason for such change, under the following assumptions.

ASSUMPTIONS GOVERNING SOLUTION.

1. Daylight, 5.30 A. M. to 6.30 P. M.
2. Maximum sustained speed of armored cruisers is 18 knots.
3. Estimated speed of Blue convoy: Maximum, 12 knots; minimum, 9 knots.
4. Convoy's earliest time of departure, 1 April, 6.30 P. M.; latest time of departure, 2 April, 6.30 A. M.
5. Armored cruisers are prepared to make 18 knots and are 5 miles northwest of Apra on 2 April, 8 A. M.
6. Search is to be conducted by trailing method. Speed during favorable visibility conditions to be scouts' maximum sustained speed; during darkness or unfavorable weather conditions, speed to be 9 knots, or such higher average speed of the convoy for earliest hour of departure, as shall have been examined at the time.
7. On 4 April, 4 A. M., the 4 northeastern ships encounter a dense fog.
8. On 4 April, by 9 A. M., the squadron commander has received radio messages from all ships, reporting clear weather.
9. One-half hour is required to communicate to all ships of the squadron by radio.
10. Scouting distance to be 60 miles.

SEARCH METHOD EXERCISE 5.

SEARCH FROM THE REAR—TRAILING METHOD.

SOLUTION.

(Sketch 22.)

Distance APRA to AMAMI, 1,260 miles.

Earliest time of departure of convoy, 1 April, 6.30 P. M. Estimated maximum speed of convoy 12 knots. Earliest arrival of con-

voy at AMAMI, 6 April, 3.30 A. M. Contact must be made before dark, 5 April.

At dark, 5 April, 6.30 P. M., convoy may be ~~1,052~~ 1152 miles from APRA.

The armored cruisers must average $\frac{\overset{1147}{\cancel{1,052}}}{82.5}=\overset{13.9}{\cancel{12.75}}$ knots to overtake the convoy by dark, 5 April. During clear weather in daylight, they can make 18 knots=234 miles. If speed is reduced to 9 knots during darkness, they would make 99 miles during the night; this would average

$$\frac{234+99}{24}=13.8.$$

There would be no difficulty in overhauling the convoy if it was known that it had departed on 1 April, 6.30 P. M. The grave danger is that it left later and might be passed during the first night in the haste to overtake it under the assumption of the earliest hour of departure.

The first object of the armored cruisers is to search as far as possible during the remaining daylight hours of 2 April. They will therefore search toward the arc of a position circle from APRA, center of arc on the direct course to AMAMI, at 18 knots, on courses such that at dark no two adjacent ships will be separated by more than 60 miles.

Ten and one-half hours at 18 knots=189 miles; they started 5 miles from APRA; they are at dark 194 miles from APRA. At 9 knots, it would have taken the convoy 21.5 hours to steam this distance.

If the convoy is not sighted by dark it is certain that it has taken a course far outside the area that can be covered by 6 ships or that it is farther from APRA, in which case if steaming at its assumed minimum speed, 9 knots, it must have departed from APRA at least 21.5 hours before 2 April, 6.30 P. M., or by 1 April, 9 P. M.

By 5.30 A. M., 3 April, the convoy can not be nearer to APRA than 194+99=293 miles under the conditions assumed.

The armored cruiser should at 3 April, 5.30 A. M., be formed on a line at right angles to the enemy's assumed course, as far toward AMAMI as is consistent with covering the arc of a circle, the center of which is APRA and the radius 293 miles, the center of the arc covered being on direct course APRA–AMAMI. The straight line is preferred to the arc of a circle as it permits of more rapid concentration.

This line is as shown on the sketch, the center of the line being 293−25=268 miles from APRA. This line can not be tangent to the daylight circle as the wing scouts would not cover the arc. It is 25 miles nearer APRA at its center than is the position circle.

On 3 April, 5.30 A. M., all ships take up 18 knots. In 13 hours of daylight they will steam $18\times13=234$ miles.

At dark the highest average speed examined for enemy's earliest hour of departure is

$$\frac{268+234}{48}=\frac{502}{48}=10.4 \text{ knots.}$$

During the night the scouts steam at 10.4 knots. At daylight 4 April the weather is foggy and this speed of the scouts must be maintained until 9.30 A. M., when all scouts have received instructions to steam at 18 knots.

From 9.30 A. M. to 6.30 P. M. is nine hours; at 18 knots equals 162 miles.

At dark 4 April the center of the line is $502+(15\times10.4)+162=820$ miles from APRA.

The highest average speed for enemy's earliest departure examined is $\frac{820}{72}=11.3$ knots.

On 5 April, 5.30 A. M., the armored cruisers are on a line the center of which is distant from APRA $820+(11\times11.3)=944.3$ miles.

If the convoy had left APRA at 1 April, 6.30 P. M., and steamed at 12 knots, it could be at this time $83\times12=996$ miles from APRA.

It is possible that it is $996-944.3=51.7$ miles ahead of the center of the line.

The armored cruisers gain on the convoy during daylight 6 miles an hour. By 6 April, 2 P. M., the Orange armored cruisers have covered the highest enemy assumed speed for earliest hour of departure; they should then change to the patrol method, running this until dark; then form a line 132 miles nearer to AMAMI than any position that could be occupied by the convoy unobserved.

THE SERVICE OF INFORMATION AND SECURITY

Addenda to chapter XIV (Pye)

(Prepared by Captain J. K. Taussig, U.S.N.)

Search from the rear -- Trailing Method; Speed of Scouts During Dark Hours.

If the scouts are of sufficient number so that they need not be placed at the maximum distance apart on the scouting line, it will be practicable for them(and pften desirable) that they steam at a greater speed during the dark hours than the minimum assumed speed of the convoy.

The range of visibility covered by the scouts at dark and at daylight is ascertained as follows;

Let r = the radius of visibility of each scout

q = the scouting distance

R = the range of visibility ahead or astern of the line

We then have $R = \sqrt{r^2 - (\frac{d}{2})^2}$

For example; suppose the scouting distance is 40 miles and the radius of visibility is 30 miles. We then have $R = \sqrt{30^2 - (\frac{40}{2})^2}$ $= \sqrt{500} = 22.36$, which is the distance ahead covered at dark by the scouting line, and which will be the distance astern covered at daylight.

If under these conditions the convoy has not been sighted at dark, it must be at least 22.36 miles ahead of the scouting line. Assuming a minimum speed for the convoy during the dark hours we can deduce the maximum safe speed.

Let h = the number of dark hours

s = the minimum speed of convoy

R = the range of visibility determined by the scouting distance

S = the maximum safe speed of the scouts.

We then have $S = \frac{h \times s + 2 \times R}{h} = s + \frac{2R}{h}$

Example: Suppose the scouts are 40 miles apart and the radius of visibility is 30 miles: The minimum speed is 9 knots and there are II hours of darkness.

What is the safe maximum for the scouts during the night?

In this case $S = s + \frac{2 \times 22.36}{II} = I3.07$

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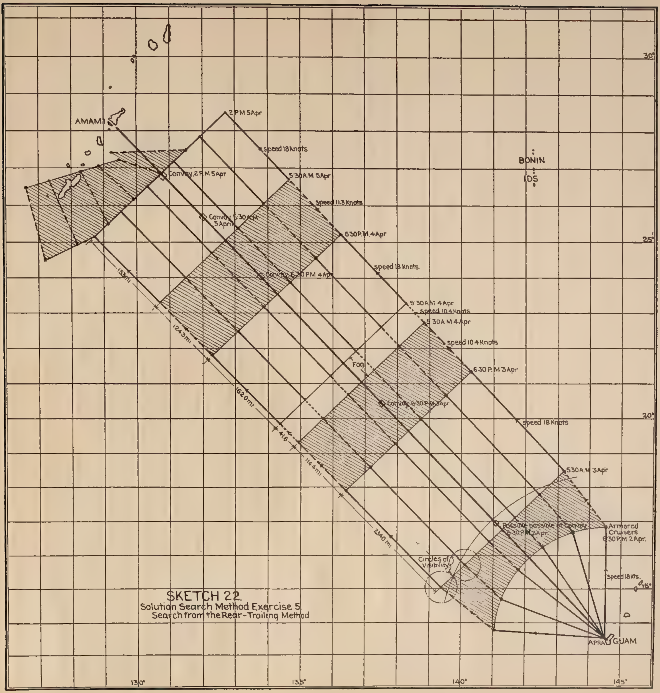
Example: Suppose the scouts are 40 miles apart and the radius of visibility is 30 miles: The minimum speed is 9 knots and there are II hours of darkness.

What is the safe maximum for the scouts during the night?

In this case $S = s + \frac{2 \times 22.36}{II}$ I3.07



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CHAPTER XV.

THE DIRECT METHOD.
THE STATION PATROL.
SEARCHING, STRATEGICAL OFFENSIVE.

CHAPTER XV.

THE DIRECT METHOD.

The standard forms of search have been discussed, except one, which is the most common in strategical scouting, and the most simple. This is the "direct method."

In the direct method, the scouts steam in such a manner as to cover a selected area, maintaining a constant speed and a steady course during favorable visibility conditions, until a fixed position is reached, or the plan is changed by further orders.

The direct method may take the form of the daylight portion of the *search from ahead;* it may be from the flank, approximating the daylight portion of the *sector method;* or it may be from the rear, similar to the daylight portion of *trailing.* It may not resemble any of these forms of search; the courses and speeds of the scouts being regulated to cover the desired area.

The main feature of the direct method is, so long as conditions remain favorable, the course and speed of each scout remains constant until contact is made or further orders are received.

The direct method is often used to cover one area while taking up a position for the use of a different method in the same or in a different area.

As an example of this, examine the problem (given as an example) in Trailing, page 146, and consider that the commander of the Orange armored-cruiser squadron had decided, instead of trailing, to search by the direct method until the armored cruisers were ahead of any possible position of the Blue force, and then to use the search from ahead.

The commander would have determined the position in which his line would have to be formed, and the time it should be formed to be ahead of the enemy, assuming the enemy's earliest hour of departure and maximum speed, and he would then have ordered the cruisers to use the direct method to the assigned position of the line to be formed. In this case the armored cruisers would steam at a constant speed both during favorable and unfavorable visibility conditions until the assigned position was reached. If they made contact, they would, of course, abandon the search. If no contact were made, they would, from their new position, start the *search from ahead.*

UNFAVORABLE VISIBILITY CONDITIONS.

When the primary object of the search is to cover the area, the method of procedure in case of unfavorable visibility conditions is similar to that of the method to which the actual operation is the nearest approach; in general terms, take up the enemy's assumed course and such speed as will prevent the enemy passing the line of scouts unobserved.

Several forms of this method of search are illustrated in the examples at the end of Chapter XVII, Strategical Scouting.

OBSERVATION.

In Chapter III, observation is defined as follows:

Operations within a fixed area, or on a fixed line, with a view to ascertaining the presence of the enemy within, or his absence from, that area, or his passage of this fixed line.

This operation may be aggressive or protective, depending upon the nature of the operations which are influenced by the information obtained.

A port in which the enemy force is known to be, may be observed to ascertain the time of departure of the enemy. If the main force is to base offensive operations upon this information, the operation is aggressive and partakes of the nature of scouting; if, on the other hand, the main force is to use this information for defensive operations, the operation is protective and partakes of the nature of protective scouting.

If the observation force has sufficient power to engage the enemy, the operation may take the form of a blockade.

In the ordinary use of the term "observation force," a weak force is implied, the only duty of which is to obtain information.

The disposition of an observation force is so dependent upon the conditions existing in each particular case that no fixed form can be decided upon.

Observation on a fixed line may sometimes be facilitated by a method of using ships which has not yet been explained. This method is called the station patrol.

THE STATION PATROL.

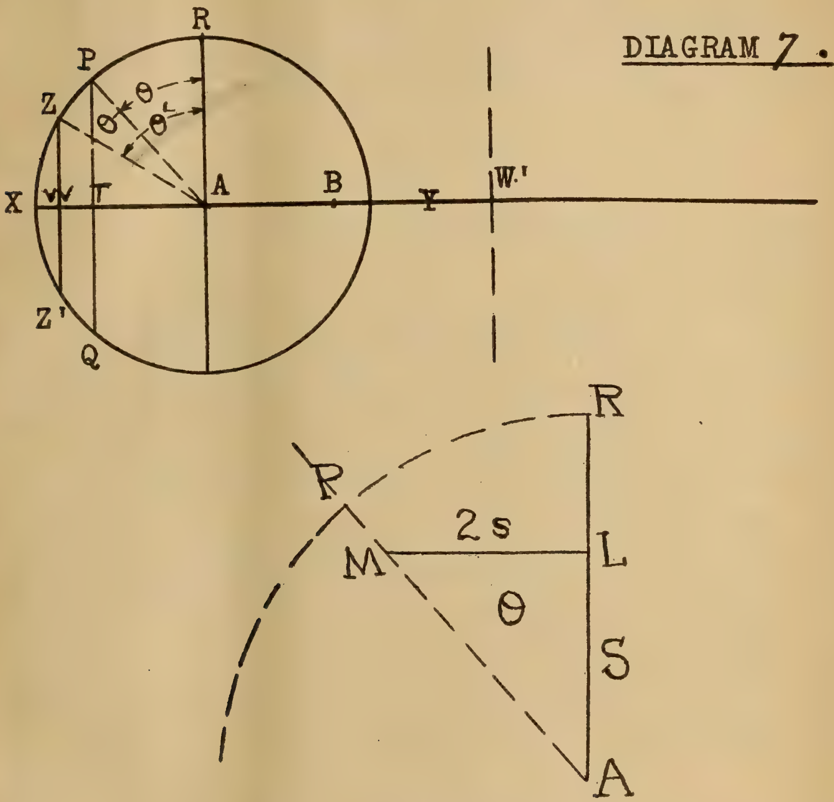
(Diagram 7.)

In the discussion of the patrol method of search, it was shown that ships underway can cover more area than ships at rest.

This fact is employed in the station patrol as follows:

The line XY is the line to be held. A scout is on this line at point A. The radius of visibility is assumed to be 30 miles. At rest, then, this scout covers, along the line XY, a distance of 60 miles, 30 miles on each side of point A.

In the station patrol, the scout steams a fixed distance toward Y, say to point B, then returns to point A. This procedure is repeated.



If the speed of the scout is taken advantage of, it can cover a distance along the line XY greater than 60 miles by this method, as will be explained.

The circle QXP is one drawn with a radius of 30 miles. It is assumed that the line XY is perpendicular to the assumed course of the enemy, as this disposition of the scouts covers the widest front.

Assume that an enemy near point P, on a course parallel to RA, is just out of sight from the scout at point A when the scout starts toward point B.

If the scout is to see the enemy, he must return to point A before the enemy has passed point Q.

Manifestly, there must be some point P which permits the scout to steam the greatest distance toward point B and return to point A in time to see the enemy at point Q. The distance AB is not, however, the entire distance covered by the scout, for he has observed the distance AT to the westward of A and a like distance to the eastward of point B.

The total distance observed by the scout is therefore AB+2(AT). There must be some value of the angle RAP (θ) for which the distance AB+2 AT will be a maximum.

This value can be obtained by calculus, but it suffices to know that Knapp and Logan have determined it to be when,

$$\text{Cot. } \theta = \frac{S}{2s}.$$

This angle is obtained graphically as follows:

S=speed of scout.

s=speed of enemy.

Lay off from A in the direction of the enemy's approach a distance proportional to S (AL). At right angles to this, from point L, lay off a distance proportional to 2s (LM). The radius AM is at the angle θ from AR. The point P is at the intersection of this radius with the visibility circle.

In Diagram 7 the angle Θ' has been laid off graphically as above described, using values S=20, s=15.

The distance Z Z′, the enemy's movement from the point where he enters the visibility circle to the point where he leaves it, divided by the enemy's speed, will give the time interval elapsing between successive arrivals of the scout at point A.

Assuming a radius of visibility of 30 miles, the distance Z Z′=33 miles. While the enemy is steaming 33 miles, the scout goes from A to B and back to A. The distance AB is then

$$\tfrac{1}{2}\left(\frac{33}{s} \times S\right) = \tfrac{1}{2}\left(\frac{33}{15} \times 20\right) = 22 \text{ miles.}$$

AW on the diagram, determined graphically, is 25 miles. The distance along the line held by one scout is 2AW+AB=50+22=72 miles, and increase of 12 miles in the distance covered above that covered by a scout at rest.

In assigning stations to adjacent scouts it must be kept in mind that the actual portion of the line held by the scout A is from W to a point a distance AW on the opposite side of point B, or W W′.

When this method is used during daylight, the position of the enemy is considered as a point because the ratio of the radius of visibility to the diameter of the column of smoke is indefinite and

the time taken to reverse course of the scout is so small in comparison to the time run on each course that it is neglected in the computation.

USE OF STATION PATROL AT NIGHT.

Sketch 23.

At night the range of visibility of an enemy ship is probably as great as that of its smoke. In searching for an enemy force of several ships it is probable that the length of their formation, compared to their range of visibility, will be relatively great. This length of formation has a marked effect in increasing the distance which can be covered by each scout.

The turning circle of the scout and the time required to turn also have a marked effect on this distance.

Sketch 23 indicates the station patrol used at night under the following assumptions:

Range of visibility of single ship—2 miles.

Speed of scout—23 knots; tactical diameter—1,000 yards.

Time required to make 16-point turn—3 minutes.

Speed of enemy—12 knots.

Length of enemy formation—4,000 yards.

SEARCHING, STRATEGICAL OFFENSIVE.

If our main body is advancing in the theater of war, the main body of the enemy is probably lying in a position in readiness, awaiting our approach. This assumption can not be considered a surety, however, and any system of search which failed to consider the possibility of the enemy main body advancing would be defective.

In order to be sure that the enemy main body does not pass our scouting line during darkness, either the scouts must move toward our main body during dark at the enemy's assumed maximum speed, or there must be two lines of scouts placed at a distance apart equal to the night steaming distance of the enemy at his assumed maximum speed, plus the night advance of the scouts.

This necessity for advancing the scouting line practically prohibits, on account of excessive speed required, any form of search other than the search from ahead, using one line of scouts, or two lines of scouts as stated above.

These two methods will be compared as regards number of ships and speed required, under the following assumed conditions:

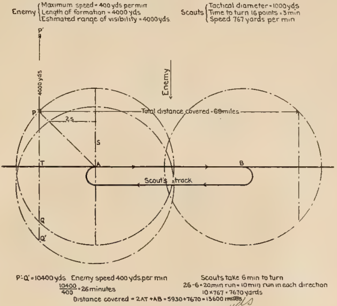
Front to be covered=600 miles.

Own main body speed=9 knots.

Enemy main body maximum speed=12 knots.

Maximum speed of scouts=23 knots.

Daylight=14 hours. Night=10 hours.



SKETCH 23.
Use of Station Patrol at night

SEARCH FROM AHEAD—STRATEGICAL OFFENSIVE.

(Sketch 24.)

Enemy main body may approach during dark=120 miles.

Scouting line must advance during 24 hours to maintain position with regard to main body=216 miles.

Scouting line advances during daylight 23×14=322 miles.

322—216=106 miles that scouts can move toward own main body during dark. Fourteen miles must be added to the distance the scouts can cover.

Scouts must, therefore, be placed so close together that their daylight radii of visibility intersect 7 miles ahead of the line joining their position, as shown in Sketch 24.

Assuming daylight radius of visibility as 30 miles, the scouts will be separated by a distance:

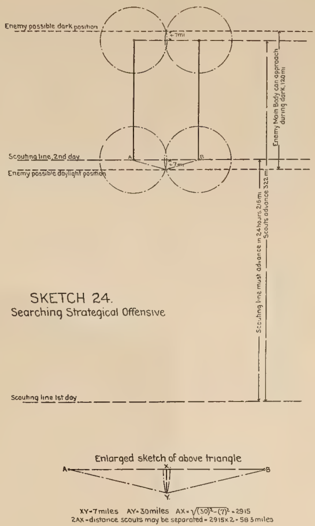
$$2\sqrt{(30)^2-(7)^2}=58.3 \text{ miles.}$$

In order to cover a front of 600 miles 11 scouts will be required. They will steam 23 knots an hour for 14 hours and 10.6 knots an hour for 10 hours. Each scout will steam 428 miles in 24 hours.

By the method of two lines 20 scouts will be required. Each scout will steam 216 miles in 24 hours.

By using the search from ahead high speed is essential, and if the enemy main body can make 15 knots the method is practically prohibited. Under the best circumstances the large expenditure of fuel will probably prevent its use.

In the foregoing discussion it has been assumed that the scouting force is not preceding the main body by a great distance. The difficulties of this method of search are many, as has been shown. It seems probable, therefore, that the scouting force should precede the main body some days, accompanied by fuel ships, and after fueling on or near the enemy's coasts search by other methods until their own main body approaches the coast.



SKETCH 24.
Searching Strategical Offensive

CHAPTER XVI.

THE USE OF HYDRO-AEROPLANES IN SCOUTING.

no doubt that aggressive air scouting and successful tracking can be pushed farther off shore than the limits suggested by the performances of the patrol planes.

(ao) In any event a strong force of air scouts operating from bases would prove of great value towards the end of the campaign when surface scouts were used up.

THE SERVICE OF INFORMATION AND SECURITY

Addenda to Chapter XVI.

Insert preceding page 161.

(a) USED FROM SHORE

(aa) Seaplanes

The performances of the N-C planes, both in maintained flight and in communications, now considerably deepen the search zones off our coasts and from our island positions. Patrol planes should be capable of locating an enemy force of 15-knot transports twenty-four hours off shore. If this can be relied on, our destroyers can lie concentrated in an interior position off the Delaware Capes from where an attack on an enemy expedition of 15-knot transports could be delivered in the night before the enemy reached any geographical objective from Cape Cod to Hatteras. It would seem, therefore, that aggressive air scouting from shore could be carried on in every case where there is a probability of carrying through offensive tactical operations before the enemy expedition reached his geographical objective.

(ab) Dirigibles

The capabilities of the present day dirigibles leave no doubt that aggressive air scouting and successful tracking can be pushed farther off shore than the limits suggested by the performances of the patrol planes.

(ac) In any event a strong force of air scouts operating from bases would prove of great value towards the end of the campaign when surface scouts were used up.

(bb) <u>For Tactical Scouting</u>

Each battleship and each battle-cruiser now carry two planes. One-half of the battleships each carr[y] one scouting and one fighting plane; one-half the battleships each carry two fighting planes; the battle-cruisers each carry two scouting planes. Each of these planes is capable of no more than one flight from a turret.

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(b) USED FROM SHIPS

(ba) For Search and Strategical Scouting

Considering the nature of the carrier:

The British have developed the following:

Ship	Displ.	Speed	Planes
FURIOUS	19,500	32	16 scouting
			6 fighting
HERMES	10,750	25	25 scouting
VINDICTIVE	9,750	30	6 scouting
			2 fighting

The Captain of the FURIOUS reports - "FURIOUS entered Helgoland Bight and sent up modern fighters to bring down German seaplanes sent out to bomb him. A captured German flyer was astonished to be brought down by high performance land planes at sea."

The scouting airplane carrier for distant search operations is assured. The flying off is well developed, but the flying on is not yet perfected. The carrier must have a speed over 30 for this latter; and means are not yet perfected always to salvage the crew of the airplane.

Developments point to every scout ultimately carrying one plane.

(bb) For Tactical Scouting

Each battleship and each battle-cruiser now carry two planes. One-half of the battleships each carry one scouting and one fighting plane; one-half the battleships each carry two fighting planes; the battle-cruisers each carry two scouting planes. Each of these planes is capable of no more than one flight from a turret.

WWP/WHF 2 July'19.

CHAPTER XVI.

THE USE OF HYDROAEROPLANES IN SCOUTING.

The successful application of the aeroplane to reconnoissance duty in land warfare, has led to very broad, and frequently ill-considered statements as to the value of hydroaeroplanes in naval scouting.

The statement has been made that the efficiency of the hydroaeroplane has made the fast ship scout useless.

The use of hydroaeroplanes must be considered from two points of view:

(*a*) Used from shore.

(*b*) Used from ships.

Information of the enemy is required for the conduct of strategical operations with a view to—

1. Offensive tactical operations.
2. Defensive tactical operations.

In (1) the operation of the scouting force is aggressive. Can an information service consisting of hydroaeroplanes only be aggressive?

In an attack upon our Atlantic coast the aim of an enemy would be the landing of an expeditionary force sufficiently powerful to seize and control an area of sufficient extent to furnish a base for future military operations.

In favorable weather ships may be beached at most any point on our coast, from Cape Hatteras to Cape Cod, without serious damage, and, the transports having been beached, the efficiency of submarines would be very greatly reduced if they were not made entirely negligible.

It is not unreasonable to suppose that such an invading force would be embarked in transports of at least 15 knots speed. In a 10-hour night this force could move 150 miles. Assuming the weather as clear, which is true only about 40 per cent of the time in northern waters in early summer, it would be necessary for the areoplanes to cover the area within 150 miles of the coast by dark each day, and the aeroplanes to be effective would have to be not more than 90 miles apart.

This would require that 10 planes fly 150 miles seaward and return without serious errors in navigation or mechanical defects.

If this efficiency can be counted upon, we may be certain of obtaining information of the enemy's approach before our coast is reached, when the weather is clear; that is, about 40 per cent of the time in early summer.

But having gained this information, of what benefit is it? Can the plane track the fleet at night? Probably not. If not, how are we to concentrate our force for an effective attack?

A force 150 miles east of the Capes of the Delaware at dark could reach these capes, Buzzards Bay, or the Capes of the Chesapeake during the morning of the day following. The fleet can not be concentrated to defend all three places.

The answer seems plain: Aggressive scouting can not be carried on from shore, and a force having only hydroaeroplanes for scouting can not be efficient.

In (2) strategical operations with a view to defensive tactical operations the hydroaeroplane used from shore might be efficient if its base was near to the position of the enemy's fleet, for the information is not required so early, and the initiative of movement lies with the fleet seeking to avoid action. This is protective scouting.

Efficient scouting must be done by ships, not aeroplanes. Aeroplanes are but an aid. By the increase in the radius of visibility from a greater elevation, the aeroplane, launched from a ship, may be used to increase the distance covered toward the flank, ahead, or to the rear.

As yet the launching of hydroaeroplanes from ships is in an experimental stage, except by means of derricks, which lower the plane on to the surface of the water.

This means can only be efficient in a smooth sea and consequently may not be available at the time it is most desired. The hydroaeroplane to-day should be considered only as an auxiliary to the scouting force, which may, in good weather, greatly facilitate the work of such force.

Assuming then that for efficiency the hydroaeroplane must be carried by ships, what is the nature of the ship which should carry the planes?

The British Navy has at least two ships fitted as mother ships for hydroaeroplanes. One was at the Dardanelles; one is with the main fleet. These ships are; one a converted ocean liner, the other a converted collier.

In both of these cases the planes are used in the immediate vicinity of the base and in no sense are these ships suitable for the work of assisting a scouting force to cover a large area hundreds of miles from a base.

In view of the wide distribution of a scouting force, it is manifestly impossible for one ship to act as a base for planes to be used

in such operations. The only efficient method is for the plane to base on the scout.

A weak scouting force carrying planes is more apt to gain information of the approach of enemy ships and is therefore a little safer from attack than one not carrying planes; but to take advantage of the security the planes give, the scouts must avoid action with the enemy. The necessity of avoiding action will cause a wide dispersion of the scouting force with a corresponding decrease in its efficiency.

An offensive screen is just as much to be feared by a weak scouting force accompanied by planes as by such a force without planes.

To assure us the use of the planes, the scouts must be of sufficient force to fight or of sufficient speed to avoid action.

The highest efficiency of the hydroaeroplane can be obtained only when the ships on which the planes are based are secure from destruction by the enemy offensive screen.

The benefit to be derived from the plane will make the destruction of all ships carrying planes a first consideration of the enemy. The tendency to consider fast scouts no longer necessary is the opposite of the conclusion reached above.

The higher the efficiency of the plane, the more its base should be protected, hence speed and power in plane-carrying ships will increase with the efficiency of the plane.

The question of visibility from a plane, its navigation, its normal speed, its method of getting away from its base are matters upon which there is little data. The following example of the methods by which planes may be used to assist scouting operations should be considered merely theoretical until actual trial shall have demonstrated their practicability.

The examples will be based upon the following assumptions:

Each scout has one plane.

Plane capable of two flights per day, each flight not to exceed 2½ hours.

Speed of plane, 60 knots per hour.

Ship to be stopped one-half hour in hoisting planes in or out.

Weather, clear. Visibility of smoke of enemy main force from plane, 45 miles; from a ship, 30 miles.

Daylight, 6 A. M. to 6 P. M.

USE OF HYDRO-AEROPLANES TO ASSIST IN SEARCH FROM AHEAD.

Conditions:

Enemy assumed maximum speed, 12 knots.

Line to be maintained.

In this method the planes may be used:

(a) To decrease the distance to be steamed by the scouts; or,
(b) To increase the distance between scouts; or,
(c) A combination of (a) and (b).

To decrease the distance steamed by the scouts.

CASE (a).

(Sketch 25.)

The scouts are placed at 60 miles distance, so that in case of weather not suitable for planes the scouts themselves could take up the scouting.

CONDUCT OF THE SEARCH.

If the weather is favorable, the planes, one from each scout, start to the rear (south) at 6 A. M. and run to points A and B, respectively, arriving at 7 A. M.

The intersection of the 45-mile visibility circles from A and B, marked X, limits the area covered to southward at 7 A. M. As the enemy could move 12 miles from 6 A. M. to 7 A. M. (the time at which the planes are in the position to the southward), a line passing 12 miles north of this intersection would give the southern limit of the area examined for enemy's position at 6 A. M.

The planes reverse their course at 7 A. M. and return to their scouts at 8 A. M.

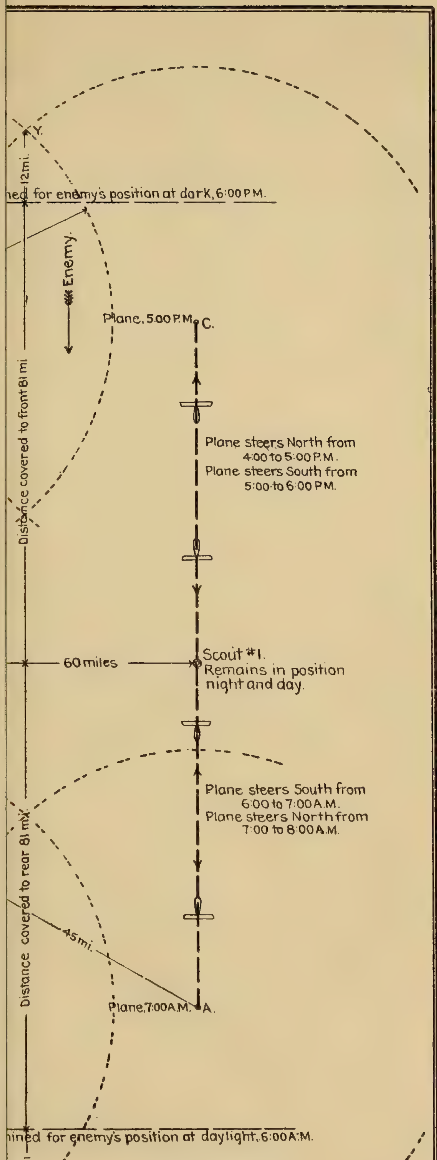
No force could pass between the scouts or within 30 miles on the outer side of either scout during daylight unobserved, but the planes must be used again to be certain that at dark the enemy is not so close to the line as to be able to reach a position to the southward of the southern limiting line the next morning.

The planes leave their scouts at 4 p. m., course north, and at 5 P. M. arrive at C and D.

The intersection of their visibility circles at 5 P. M. (marked Y) is the limiting position to the southward that the enemy could occupy unobserved at 5 P. M. An enemy on this line at 5 P. M. could be 12 miles farther south by dark, 6 P. M., so a line 12 miles south of Y is the limiting line for dark.

The distance actually covered to the front and to the rear in the 12 hours of daylight is XY—24=162 miles. As this is more than the enemy could steam during dark (12×12=144), the line will be maintained efficiently, although the scouts have not moved.

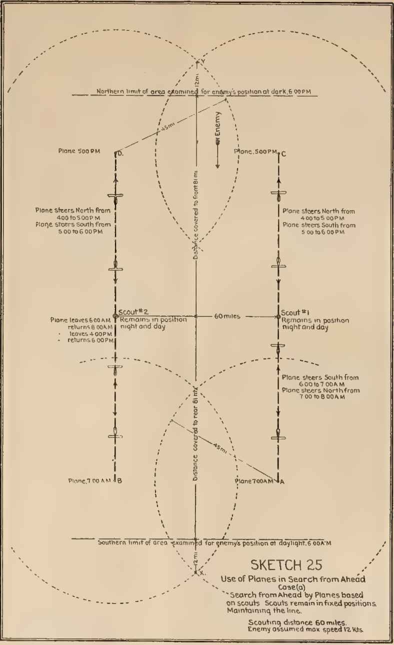
It will be noticed that a large part of the area covered by this method is in rear of the line of scouts. This area can be covered only by the planes. If during the night the weather becomes such as to threaten the use of planes at daylight, the scouts should move to the rear 144—81=63 miles before daylight.



SKETCH 25.

Use of Planes in Search from Ahead.
Case (a)
Search from Ahead by Planes based on scouts. Scouts remain in fixed positions. Maintaining the line.

Scouting distance 60 miles.
Enemy assumed max. speed 12 Kts.



SKETCH 25
Use of Planes in Search from Ahead
Case (a)
Search from Ahead by Planes based on scouts. Scouts remain in fixed positions. Maintaining the line.

Scouting distance 60 miles.
Enemy assumed max speed 12 Kts.

26051—16. (Face p. 164.)

TO ADVANCE THE LINE.

To advance the line, the scouts would move ahead from 8 A. M. to 4 P. M. the amount of the required "Advance."

ADVANTAGE OF METHOD.

The great advantage of this method lies in the ability to maintain the scouting line without much consumption of fuel. The scouts would burn fuel for a very low speed, just sufficient to maintain their position. If the planes were not used, the scouts would have to steam continuously at 12 knots to maintain the line.

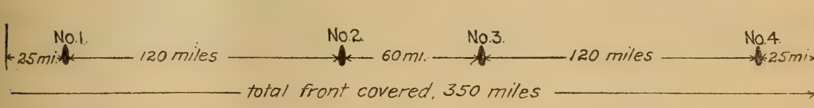
USE OF TWO SCOUTS AND TWO PLANES TO COVER GREATER FRONT.

CASE (b)

(Sketch 26.)

In Sketch 26 is shown the method of employment of two scouts, each with one plane, to cover a front of ~~170~~ 180 miles.

In this method, each plane is required to make two flights, each flight toward the other scout. The distance outboard of the scouts covered by this method is small. It will be noticed that if 4 scouts were employed the distance between pairs of scouts could not be 120 miles, as each scout uses both flights of its plane on the same side. If 4 scouts were to be used, they would be spaced as shown below:



Without the use of planes, the front covered would be but 240 miles.

Conditions.—Enemy assumed maximum speed, 12 knots; line to be maintained.

CONDUCT OF THE SEARCH.

Scout No. 1 puts over its plane at 5.30 A. M. and at 6 A. M. the plane leaves A′ for A″, distant 60 miles.

This plane would sight an enemy force, which at 6 A. M. was to northward of the line XY. Scout No. 2 would see an enemy which was within its visibility circle at daylight. The most northern point of these two limiting lines is the point of intersection Y. A line perpendicular to the course of the enemy passing through Y is the southern limit of the area, all of which is covered for 6 A. M.

Scouts Nos. 1 and 2 steam north at 12 knots at 6 A. M.

At 8 A. M. scout No. 1 stops for half hour to pick up its plane.

At 7 A. M. the enemy would have been discovered if to the southward of position Z, but an enemy steaming south from Z would be sighted by scout No. 2. An enemy at Z′ would just escape detection, so the plane from scout No. 2 must start in time to reach a position from which it could see such enemy.

Suppose the plane from scout No. 2 leaves B′ at 9.30 A. M. At 10 A. M. it would be 30 miles west of its starting point at B″. An arc of the 45-mile visibility circle from B″ has been drawn to the southward to show that the enemy, who could now be at Z″, would be in sight from the plane.

The plane from scout No. 1 leaves again at 1 P. M., returning at 3 P. M.

The plane from scout No. 2 leaves again at 4 and returns at 6 P. M.

At 5 P. M. the plane would have sighted an enemy lying on or within a circle having its center at D‴, and a radius 45 miles.

At 6 P. M. scout No. 1 would see any enemy lying within its circle of visibility, radius 30 miles.

An enemy at U at 5 P. M. would just reach the scouts' visibility circle at 6 P. M.

Any force lying at 6 P. M. to the southward of the line U′V, and between the intersections of this line with the outboard arcs of the scouts' visibility circles, would have been sighted.

The front covered by this pair of scouts, each with one plane, is 150 ~~170~~ miles. The scouts would have been placed 120 miles apart.

The distance the line of observation, has ~~having~~ been moved to the front 150 miles during daylight, assures the scouts that the enemy can not pass the southern limit of their scouting area by daylight.

In Case (a), Sketch 25, was shown how 2 scouts, each with 1 plane, capable of making 2 flights of 2½ hours' duration during each day, could maintain the line without an expenditure of fuel greater than that required to maintain their positions.

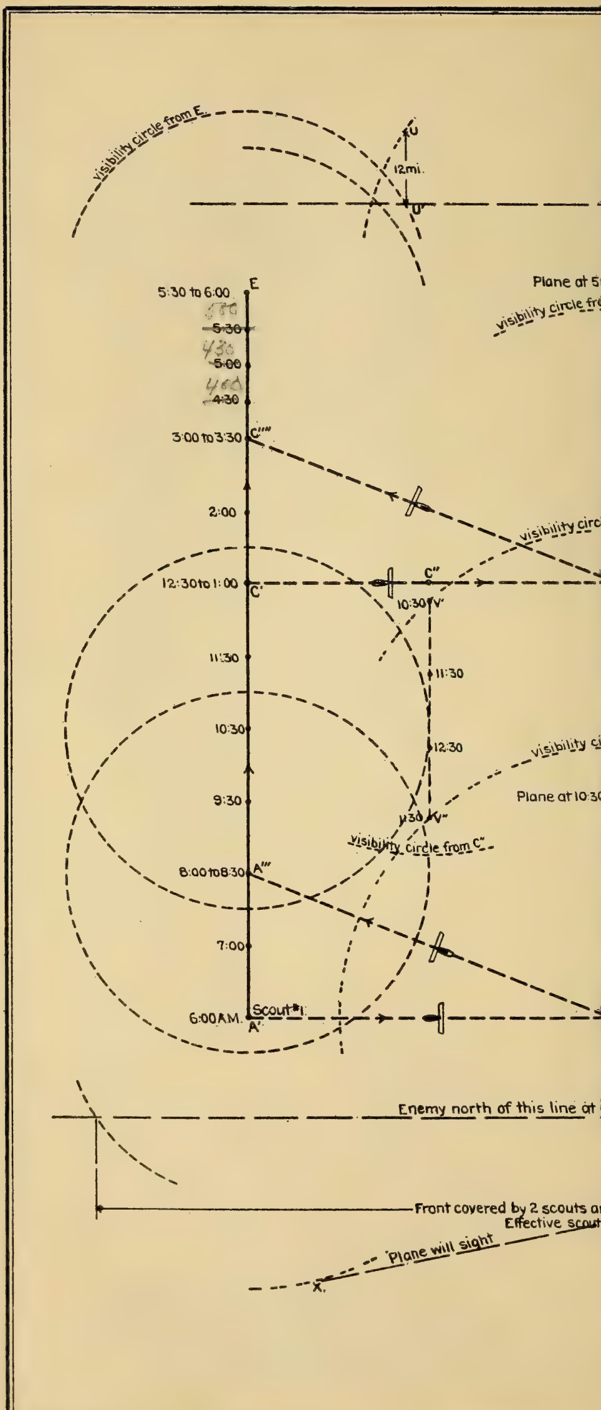
In Case (b), Sketch 26, was shown a method of maintaining the line at a greater distance between scouts, each scout steaming to the front during daylight at 12 knots, except during the time required for getting out and picking up planes, and during the night steaming to the rear at ~~10~~ knots. The second method requires quite an expenditure of fuel, as the total steaming for 24 hours is 240 miles.

10.5

CASE (c)

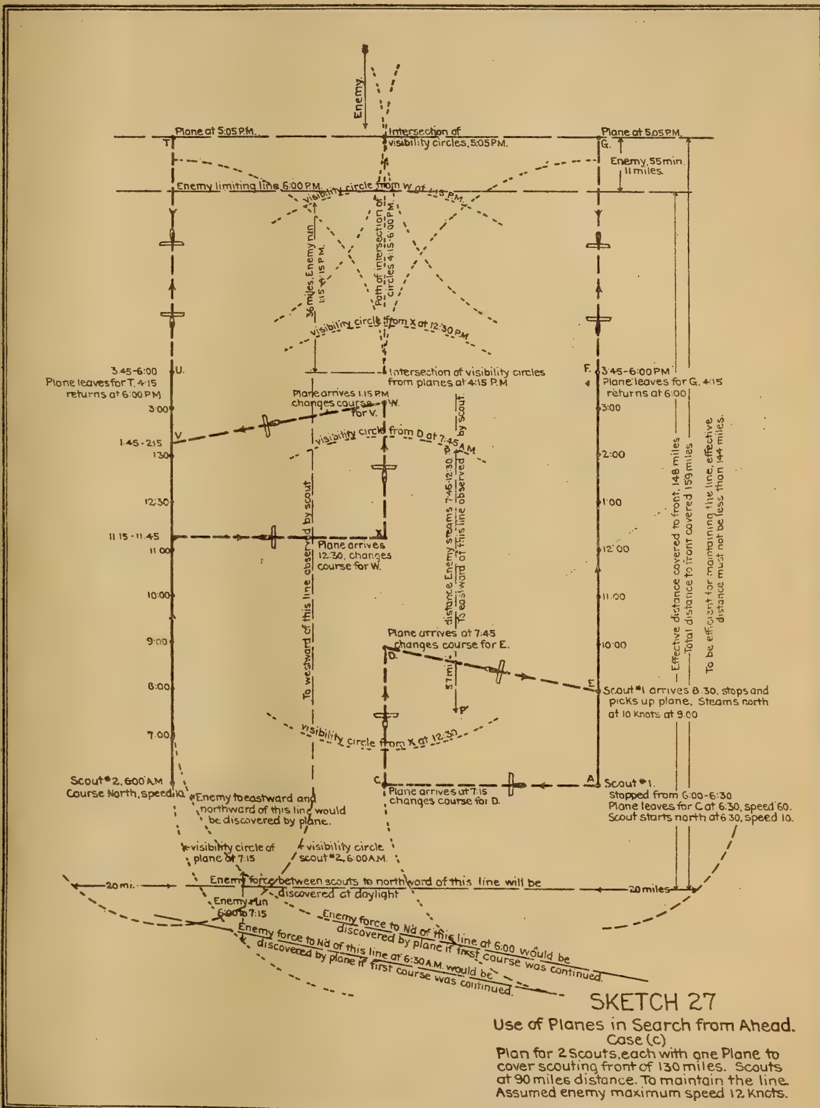
(Sketch 27.)

Case (c), Sketch 27, shows a method of using 2 scouts, each with 1 plane, which is a combination of cases (a) and (b). The distance between scouts is 90 miles, each scout covers 20 miles outboard at



26051—16. (Face p. 167.)

daylight, so the pair covers a front of 130 miles. The distance steamed by each scout is 175 miles. The daylight speed, except when stopped, is 10 knots; the night speed a little over 7 knots.



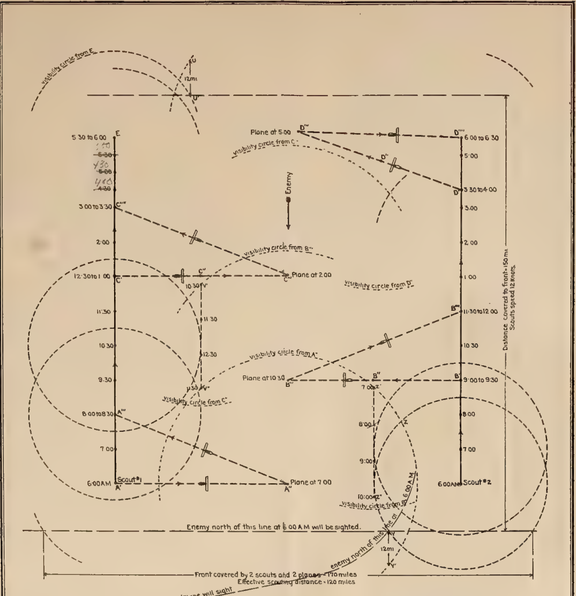
SKETCH 27

Use of Planes in Search from Ahead.
Case (c)
Plan for 2 Scouts, each with one Plane to cover scouting front of 130 miles. Scouts at 90 miles distance. To maintain the line. Assumed enemy maximum speed 12 Knots.

USE OF PLANES IN SEARCH FROM THE FLANK.

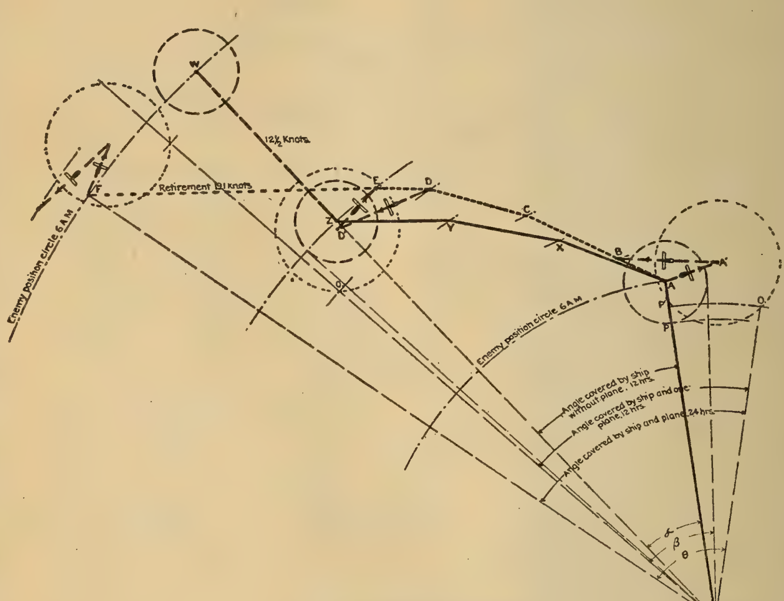
(Sketch 28.)

The value of planes in the search from the flank lies principally in increasing the angular distance that can be searched for the assumptions under which the scout is searching.



SKETCH 26.
Use of Planes in Search from Ahead
Case (b)
Plan for 2 Scouts each with one Plane to cover front of 170 miles. Maintaining the line
Assumed enemy maximum speed 12 Knots.

It has been pointed out in a previous chapter that in running retiring search curves the angular distance that can be searched by a scout is dependent upon the distance from the enemy's point of departure at which the search is begun and also the ratio of the speeds of the scout and the force for which the search is being conducted, the angle being greater as the ratio of speeds is greater.



SKETCH 28.
Use of Planes in Search from the Flank
Independent or Sector Method
Enemy assumed speed 12½ Knots.
Scouts speed 20 Knots.

For this reason the decrease in distance steamed by the scout, due to the necessity to stop during the hoisting out and hoisting in of the planes, decreases the angle covered by the scout itself.

This decrease in angle of search is, however, more than made up by the additional angle which is searched by the plane.

In Sketch 28 a method of using a single plane to increase the angle searched is shown.

The scout of 20 knots speed is at point A on the enemy's position circle for daylight, 6 A. M. If the scout had no plane, the scout would run the search curve AXYZ. The angle actually covered by the ship would be the angle α. The angle covered for the assumed conditions, visibility 30 miles, is β.

If we assume, however, that the scout is one of a group operating at a distance of twice the range of visibility, 60 miles, in order to cover inaccuracies in assumed enemy speed or time of departure, the angle searched is reduced to α, the angle actually covered by the scout.

By using one plane, making two flights, one just after daylight and one before dark, the angle through which this zone may be searched is materially increased, during the daylight period being the angle θ.

CONDUCT OF SEARCH.

The plane is put over at point A before daylight, and at daylight the scout steams at 20 knots for point B. Point B must be on the enemy position circle for 8 A. M. and such that the plane can in two hours at 60 knots scout to A′ and back to B.

The scout stops ½ hour at B, hoisting in the plane, and at 8.30 A. M. starts at 20 knots for a point on the enemy's noon position circle C.

At noon the scout changes course to reach a position on the enemy's 4 P. M. circle. The point D must be reached by 3.30 P. M., and the plane hoisted out ready to commence the search at 4 p. m.

From 4 P. M. the scout runs at 20 knots from D to E, and at E stops and picks up the plane after 6 P. M.

From position D the plane scouts to D′ and returns to the scout at E.

The angle through which the zone of 60 miles has been scouted is limited by the radii from the enemy's point of departure passing through the points O and O′.

Point O is determined as follows:

With A′ as a center, draw a circle with a radius of 45 miles, assumed radius of visibility from the plane. This is the limiting circle of vision when the plane is at A′, which is at 6.40 A. M.

To determine the arc covered for a zone of 60 miles, it is necessary to consider that an enemy was at daylight on a position circle 30 miles nearer the point of departure than the position of the scout, say point P.

In 40 minutes this force could have reached point P′. If, with the point of departure as a center and a radius from this center to P′, we swing an arc cutting the visibility circle of the plane at the corresponding time, we obtain the point O. A radius through this point is the limiting radius of the arc searched.

Point O′ is similarly determined for 5.20 P. M., the time when the plane will be at D′.

In retiring during the night a scout without planes would be required in order to cover the 60-mile zone to retire along the radius from the enemy's point of departure. A scout having a plane can retire to such a position on the enemy's next daylight position circle that the new limiting radius to the eastward corresponds with the western limiting radius at dark; that is, to point F.

It will be noticed that during this retirement the scout must steam 210 miles in 11 hours, 1 hour of dark being consumed in picking up and hoisting out the plane. This requires a speed of 19.1 knots during the night.

It is necessary to use high speed continuously to take advantage of the additional angle that can be covered by the plane, and for this reason it may often be necessary to abandon this plan.

The same principle of extending the angle searched may be applied in using the patrol search, but care must be exercised in determining the distance between scouts when scouts are required to stop. It is doubtful if the planes add much to the efficiency of this type of search unless the speed of the scouts is low.

In general, it may be considered that in the retiring search methods, planes are efficient in increasing the area covered, but not in increasing the range of assumptions as to the enemy assumed speed or time of departure.

USE OF PLANES IN SEARCH FROM THE REAR.

The use of planes in *trailing* is very similar to their use in searching from ahead. An increase in distance between scouts decreases the amount the scouts can overhaul the enemy in a given time.

The first thing to consider is whether it is desirable to cover a wide front, or, by decreasing the front, overhaul the enemy more rapidly.

Case (a) indicates the method when great front is required.

Case (b), when great rapidity of overhaul is required.

CASE (a).

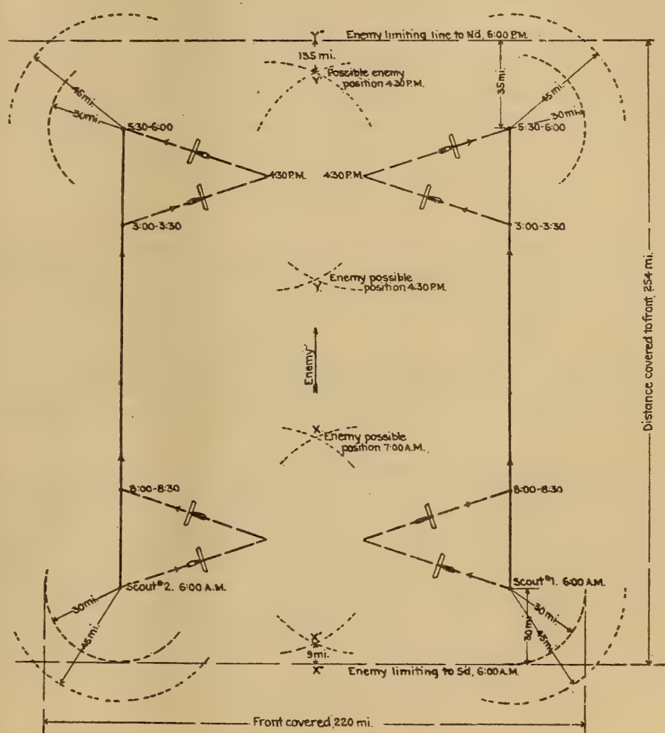
(Sketch 29.)

In this case each scout has its plane out and steams ahead at 18 knots at 6 A. M. At 8 A. M. each scout stops to pick up its plane.

The planes steer for a point 18 miles north of their starting point and 60 miles inboard. Upon reaching this, they return to their respective scouts.

The two circles of visibility from the planes interesect 40 miles ahead of their 7 A. M. position, at point X, and 40 miles in rear at point X′.

The enemy's minimum speed is assumed as 9 knots. During the time the planes have moved toward the center of the line, 6 A. M. to 7 A. M., the enemy may have steamed 9 miles, so the limiting line to



SKETCH 29.
Use of Planes in Trailing.
(to cover widest possible front.)
Scouts speed 18 Kts.
Enemy minimum assumed speed 9 Kts.

the southward for the enemy's position at 6 A. M. will be a line parallel with the scouting line passing through X″, 9 miles south of X′.

The enemy may be at 7 A. M. just to the northward of point X unobserved. Assuming the enemy at this point and moving north at

9 knots, the planes must be again in the corresponding positions when such intersection of their circles to the rear would just coincide with the position the enemy could reach at 9 knots, assuming that he was just out of sight from their positions at 7 A. M.

The planes must be back to their respective scouts by dark, 6 P. M. In view of the possible delay which might be encountered in hoisting in planes after dark, and the high speed at which the scouts steam during the night, this speed being materially increased in case of a delay, it seems advisable to start the second trip of the planes at 3.30 P. M. in order to have them hoisted in by 6 P. M.

At 4.30 P. M., when the planes turn back toward their respective scouts, they could see an enemy to the southward of a line passing through the intersection of their circles of visibility, Y′.

From 4.30 P. M. until dark the enemy at his minimum assumed speed could move $1\frac{1}{2}\times 9=13\frac{1}{2}$ miles. At dark, then, the enemy would have been observed if he was to the southward of the line passing through Y″.

The total distance covered to the front is the distance from the line passing through X″ to the line passing through Y″, which is 254 miles.

During the night the scouts move to the front at such rate of speed that the limiting line to the southward at 6 A. M. the next day will not be more than $12\times 9=108$ miles north of the limiting line for 6 P. M.

The distance covered to the rear of the scout's position at 6 A. M. is 30 miles. The distance covered ahead of the scout's position at 6 P. M. is 35 miles. The minimum distance that the enemy will steam during the night is assumed $12\times 9=108$ miles. The scouts should steam $30+35+108=173$ miles. As they must stop to get out planes at 5.30 A. M., the time for steaming this distance is $11\frac{1}{2}$ hours,

$$\frac{173}{11\frac{1}{2}}=15+\text{knots}.$$

In this method, the distance covered to the front during daylight is 254 miles. An enemy at 9 knots could make 108 miles. The overhaul is $254-108=146$ miles.

TO OBTAIN THE GREATEST OVERHAUL.

CASE (b).

(Sketch 30.)

In order to overhaul the enemy most rapidly, it is necessary to take advantage of the distance which can be covered to the front and rear by the planes steering courses parallel with those of the scouts.

This is accomplished by sending the planes directly astern at daylight as far as they can go and return to the ship without necessitating any reduction in speed by the scout, except such stops as are required for hoisting planes out and in.

Assuming for safety that the plane should not attempt more than a two-hour flight, we obtain the distance the plane can go to the rear as follows:

The plane moves 120 miles. The ship will, in this same time, move to the front $18\times2=36$ miles. The distance to the rear of the 6 A. M. position that the plane can go is

$$\frac{120-36}{2}=42 \text{ miles.}$$

At night the plane can go ahead of the 3.30 P. M. position

$$\frac{120+36}{2}=78 \text{ miles.}$$

The scouts run at 18 knots, except when stopped for planes.

In order that there shall be no possibility of passing the enemy unobserved while the planes are on board the scouts, the scouts can not be more than 60 miles apart.

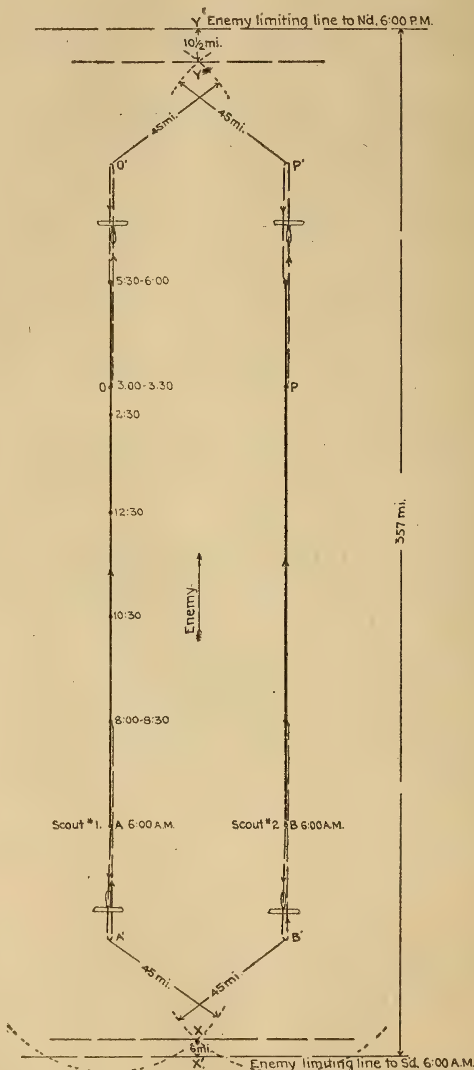
A and B are the 6 A. M. positions of 2 scouts. Scouting course, north; distance, 60 miles. The planes leave A and B at 6 A. M., and arrive at A′ and B′, 40 miles south of A and B, at 6.40 A. M. The circles of visibility from the planes intersect, at this time, at point X. An enemy moving at 9 knots would move 6 miles between 6 A. M. and 6.40 A. M. The southern limiting line for the enemy at 6 A. M. would be a line parallel to the scouting line passing through X′, 6 miles south of X. This line is 79 miles south of the scouts' positions at 6 A. M.

The scouts move forward at 18 knots from 6 A. M. to 8 A. M. and then stop awaiting the planes. At 8.30 A. M. they go ahead at 18 knots.

At 3 P. M. the scouts stop and get out planes. The planes go from O to O′ and P to P′ and return to their scouts at 5.30 P. M.

At 4.50 P. M. the intersection of the visibility circles from the planes is at Y. An enemy at Y at 4.50 P. M. could steam to Y′, a distance of $1\frac{1}{6}\times9=10\frac{1}{2}$ miles by 6 P. M. The limiting line for the enemy at 6 P. M. is a line parallel to the scouting line passing through Y′, $10\frac{1}{2}$ miles north of Y. This line is 89 miles ahead of the scouts' positions at 6 P. M.

The total distance covered during daylight by scouts and planes is $79+89+10.5\times18=357$ miles. An enemy at 9 knots could have steamed $12\times9=108$ miles in this time. The overhaul, then, is $357-108=249$ miles during daylight.



SKETCH 30.

Use of Planes in Search from the Rear. Trailing.

Maximum Over haul.

Scouts speed 18 Knots.

Enemy minimum assumed speed 9 Kts.

CHAPTER XVII.

CONTACT SCOUTING.

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CONTACT SCOUTING.

In the preceding chapters, the various methods of search have been described. Much time and study are required to perfect a knowledge of such methods and of their use in actual operations, and even when these methods have been mastered, one is but at the threshold of the art of naval war.

Search is only a means to an end; the end must be attained on the field of battle; the most perfect search operations, the most skill-ful contact scouting, the most inspired strategy can not of themselves ensure success.

A commander, who can conduct an efficient search and can perform efficient contact scouting, arrives on the field of battle with certain advantages, and that is all.

He may find his enemy surprised, outmaneuvered, and ripe for defeat. But the ordeal of battle must be undergone; and until one side has inflicted and the other accepted defeat on the battle field, that success which is the object of war has not been achieved.[1]

Search has been defined as : " Operations to find the enemy." But finding the enemy is probably the simplest of the operations which precede the battle.

The next phase is called *contact scouting* and is defined as: Scouting operations when in contact with the enemy.

Having located the enemy, the scouting force assumes the task of gaining information concerning the enemy; his direction of movement, strength, composition, and disposition of his forces.

Efficient contact scouting should furnish sufficient information of the enemy to make it possible for those who are responsible for the conduct of the operations of the fleet, to gauge the extent of the enemy's power, to fathom his intentions, and to make the proper disposition of the fleet to effectually oppose the enemy.

In the discussion of search operations no mention has been made of a support for the scouting line. The consideration of a support does not enter into the operation of search, for manifestly a support is not required until the enemy is encountered, at which time the operation becomes contact scouting.

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[1] Henderson : "Art of reconnaissance."

26051—16——12

The information which the scouts can obtain does not generally extend much beyond the surface of the enemy's screen. The usual type of scout is not of sufficient power to force its way through the enemy screen to see what lies behind it. Speed and numbers may in some cases permit a group of scouts to outmaneuver an enemy screen and gain the desired information, but usually strength will be required in the nature of a support.

Battle cruisers combine the speed of a scout with the power of a battleship, and consequently in daylight can be opposed only by major ships. This power, which facilitates the piercing of the enemy screen as soon as it is encountered, is of immense value, as no time is lost by waiting for the support to come up and pierce the enemy screen, and the enemy has no time to organize an effective resistance. The speed of the battle cruiser practically assures its safety from attack by battleships and aids it in avoiding the enemy destroyers, which are, after dark, the natural enemy of strong scouting forces.

The difficulty encountered by destroyers in making a speed near to their maximum in a moderate head sea affords the battle cruiser an avenue of escape. The battle cruiser should, when possible, approach an enemy screen from such a direction that it can retire with the sea ahead.

The support of a long scouting line may require many hours to arrive at a point of contact with the enemy screen, and during this period the scouts must do what they can to maintain contact.

With the increase in mobility of modern fleets, and the disadvantage to the scouts of the curtain which night draws between them and the enemy, the difficulty of keeping touch with the enemy is fully as great as that of originally gaining touch. Sometimes, indeed, it is more so, for the knowledge that the scouting force is in touch with his force may cause the enemy commander to take measures to drive off such scouts, and maneuver his main force so as to retard another contact with the scouting force, or to operate to deceive the scouts.

When darkness comes, scouts must be withdrawn unless the attacking force is close enough to take advantage of the scouts' information for an attack during the night. When the attacking force is in this position, scouts must often be sacrificed to gain the information necessary for the success of the attack.

Scouts remaining in contact at dark, with the screen of an enemy force accompanied by destroyers, are in grave danger, and such procedure is unwarranted unless the information that they can obtain will assist offensive tactical operations.

When a force is constantly under observation by enemy scouts, it is said to be "picketed."

The ideal of "picketing" is an elastic cordon of vigilant scouts, who retire whenever pressure is applied and close whenever pressure is withdrawn, informing their supports of any move of the enemy, so that detached groups may be fallen on and either cut off or driven back on their own main body.

Short of actual defeat, there are few experiences more unpleasant to a commander than the sensation of being "picketed." Not only are his dispositions plain to the enemy, but his own efforts to gain information or drive off the enemy scouts are usually frustrated, unless undertaken on a large scale and at some risk.

What has been said previously concerning scouts remaining in the vicinity of a screen near dark, when the enemy has destroyers, will indicate that "picketing" is a much more simple operation against a force which has no destroyers.

The conclusion which is to be drawn from a consideration of the possibilities of contact scouting is, *to assure success, a superior force in types suitable for scouting operations is essential.*

Numbers alone do not constitute superiority; speed and power of the ships, efficiency, training, and morale of the personnel are all factors which must influence an estimate.

Even if the enemy should have a preponderance of force in types suitable for such operations, there is yet a possibility of securing good results from contact scouting. It is impossible for the enemy to insure superiority everywhere, and an inferior force well handled may be able to assert a local superiority at some point. The possibility of such success is dependent principally on the possession of one advantage—superior information—and this can be obtained only by taking the initiative and establishing early an efficient system of scouting, which amounts to saying: The better information a commander has, the more likely he is to get more.

Contact scouting efficiently carried out, must furnish information of the enemy's strength, disposition, and general direction of movement, upon which information are based the strategical operations of the main force; and later, more detailed and constant information of the enemy, upon which offensive tactical operations are based.

This difference in the nature of the information required and the difference in methods of operation of the scouting force in these two phases of the operation of contact scouting gives rise to two types of scouting, both of which are included in contact scouting. These two types of operations are called *strategical scouting* and *tactical scouting*, and are treated in the succeeding chapters.

CHAPTER XVIII.

STRATEGICAL SCOUTING.

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Strategical scouting is: Operations after a contact with the enemy's main force or its screen, before one's own main force, or other force detailed to attack, is within striking distance, to determine the general direction of movement, composition, and disposition of the enemy's main force and its screen. Upon the information thus obtained are based the strategical operations of the attacking force with a view to assuming the tactical offensive.

The second phase of scouting operations, strategical scouting, commences with the location of the enemy main body or screen, and continues until the forces are within striking distance. It may last for days, or, if the forces are close when discovered, it may not exist at all.

Scouting operations during this phase assume a new form. The area of profitable employment of the scouting force becomes restricted. Most of the ships that have been employed on search duty lie well outside this area. At least one night's steaming will be required before many of these ships can be of service.

The object of strategical scouting is to obtain information of the enemy upon which the commander in chief or the commander of a force detailed to attack, is to base his strategical operations. The chief points to be determined are:

1. Enemy location.
2. His approximate strength.
3. His direction of movement.
4. Presence or absence of train and destroyers.

With modern naval forces it may be assumed that the portion of the force maintained near the main body for protective scouting, protective or defensive screening, will be stronger than that portion of the scouting force making the first contact with the enemy main force.

Under these conditions it is reasonable to suppose that not more than one contact will be made until a considerable concentration of the scouting force has been effected.

When one's own main force or force detailed to attack, is so distant from the enemy main force that no engagement can take place dur-

ing the daylight of discovery or during the succeeding darkness, continuous tracking should be attempted only if no opposition is encountered.

Having once located the enemy main body, if opposition is encountered, attempts to track or even to make further contacts before a considerable concentration of the scouting force has been effected might, and probably would, result in a loss incommensurate with the value of the information gained.

If a contact is made with the enemy main body in the morning, a sufficient force may possibly be concentrated by late afternoon to warrant an attempt to make a second contact. This contact should be made only if possible to do so without undue risk. If the first contact is made in the afternoon, no further contact should be attempted until the following daylight, unless no resistance is encountered while tracking.

The radio signal reporting the discovery of the enemy main body, with the time of sighting, location, enemy's estimated course and speed, should be sent broadcast and relayed to all ships of the scouting force.

The commander in chief or scouting force commander, if there be one, should be immediately informed by group commanders of the location of each group of scouts and of their anticipated plan of action.

The first report to the commander in chief should, if possible, contain additional information of the enemy's approximate strength, presence or absence of train, and destroyers.

In general, it may be said that during strategical scouting the interval of time elasping between contacts with the enemy main body, depends upon the distance that separates the main forces, or the enemy main force and one's own destroyers, or other force detailed to attack. If the distance is great one contact in each daylight may be sufficient. As the forces approach the time intervals between contacts should decrease until strategical scouting merges into tactical scouting.

The first evidence of the enemy will probably be one or more contacts along the scouting line with enemy ships. It is important for the searching ships to avoid engagements unless of markedly superior force and such engagements are necessary in carrying out their mission of gaining information. If compelled to change course to avoid an enemy a scout should take such course as will soonest avoid the enemy and permit a return to the original plan. The necessity for leaving station should always be reported to the ships next on each side and to the group commander, with a statement of the action taken with regard to the enemy.

A force carrying on a search must not concentrate immediately upon contact with enemy ships, for the presence of enemy ships is not a sure sign that the enemy main body is in the vicinity. If the enemy could count on a concentration of the scouting force upon the point at which contact was first made, it would be easy for his main body to pass the line at another point during such concentration.

The support of the scouting line may be directed to steam in the direction of such contacts, but such contacts must not weigh too heavily in making a decision, for they may be only a means to draw attention from the real point at which the enemy intends to pass. Until the enemy force searched for is located, ships on search duty should remain in their assigned area unless their instructions are changed.

In case there is no support for the scouting line, it may be necessary for the ships of the scouting line to concentrate for mutual support. They should then reconnoiter as a group. Such procedure confines the area covered to very small limits and should only be done when absolutely necessary.

In the foregoing discussion it was pointed out that the sighting of a few enemy's ships may not prove that the enemy's main body is in the immediate vicinity. If, from the formation of these ships, it appears that they are arranged for the purpose of denying information, the evidence that the main body is present becomes stronger, and the scouting force should proceed to develop the enemy's screen with a view to piercing it and ascertaining what, if anything, lies behind it.

If the enemy's ships sighted assume the tactical offensive, it may be necessary for the group of scouts to concentrate for mutual support, and reconnoiter as a group. If the enemy's ships do not assume the tactical offensive, the scouting ships should endeavor to develop the screen formation and composition.

Few fleets have a sufficient number of ships suitable for screening, to form an offensive or protective screen of any great strength. The first duty of the scouts making contact with the screen should, therefore, be the reconnaissance of the screen in order to ascertain its weakest point. This information will be of service in directing further operations when the support of the scouting force shall have come up, or the scouting force shall have concentrated enough ships to undertake to pierce the screen.

The attempt to pierce the screen should usually be made as soon as practicable for, until the screen has been pierced and the enemy main body located, there is always a chance that the scouts are following a false screen. The time element may be the governing

factor in the decision as to when to attempt the first piercing of the screen. It may be possible to obtain the desired information by means of ~~flying boats~~ scouting planes even without piercing the screen. Stealth is preferable to force, for an attempt to pierce a screen is almost sure to result in heavy loss.

The necessity for the use of force in attempting to gain the desired information is greatly dependent upon the value of immediate information. An enemy's screen encountered in the position anticipated by the commander in chief need not be pierced as soon as a screen in a position far distant from the anticipated one. If the position of the screen indicates the necessity of a marked change in the present strategical disposition, such sacrifice as is necessary must be made to obtain the desired information immediately.

As soon as the enemy main body is positively located, search operations should be discontinued without further orders, and all searching ships should head for the position in which the enemy main body was last reported.

These courses, for the point at which the enemy was located, should be continued until further information is received concerning the enemy's course and speed The scout which made the contact may soon be driven off or sunk, and the enemy may then make a decided change in course in order to avoid further contacts. The approach of the other searching ships toward the point at which the enemy was located, causes them to cover a wide arc as they approach, and, even if the scout which made the contact has been driven off or sunk, they may make contact with the enemy, though he has made a decided change of course.

If a scout in contact with the enemy main body is able, by the enemy's inability to drive him off, to make frequent reports of the enemy's course and speed, the ships of the searching force should take such courses as will soonest bring them in contact with the enemy, unless they receive instructions to the contrary.

When an enemy makes no endeavor to drive off the tracking ships the commander of the scouting force should consider whether the condition presented justifies him in allowing all the scouting ships to expend fuel for high speed to gain contact. If by the use of high speed a scout could just make contact by dark, it is seldom advisable for him to try to do so. It would be better for the scout commander to direct such scout to take a course and speed that will bring it near the position that the scout commander expects it to occupy at daylight the day following. In large scouting operations logistics play a prominent part, and every endeavor should be made to gain all the desired information with the least expenditure of fuel.

When, after a contact with the enemy screen, a scout attempts to reconnoiter the screen, great care must be taken to avoid traps or

pockets in the screen. The courses taken should be such that the component in the direction of the enemy's course is approximately equal to the enemy's speed. Close contact with enemy ships should be avoided until the screen has been more or less clearly developed. The sacrifice of scouting ships, which is often made in the chart maneuver, can not be justified. The loss of ships early in a campaign will have a serious moral effect.

A strong protective screen will seldom be used by a force, unless accompanied by a train, for without the train the force would have sufficient mobility to avoid general engagement, and the exposure of major ships as the support of the screen would be a serious disadvantage. The presence of the train reduces the fleet's mobility and subjects it to sudden attack, unless the area around the train is maintained free from the enemy's scouts.

The handicap placed upon a force by the presence of the train is one of the principal conditions that lead to an early attack by the fleet that is based within the theater of operations. This attack may be only a destroyer attack in the nature of a raid, but under any conditions the destroyer attack will probably be attempted.

This threat leads the fleet approaching the theater of operations to use a strong offensive or protective screen to deny to the enemy information of the location of the main force and train. In order that the screen may be effective it must cover a large area, and in order to be strong enough for its designed purpose it must be supported by major ships. Destroyers in groups may be placed in the outer line of a protective screen for the purpose of following and attacking enemy scouts that remain in the vicinity of the screen near nightfall.

The above general discussion of strategical scouting should indicate the sequence of events as follows:

(a) The sighting of enemy ships.

(b) Maneuvering to ascertain whether the enemy ships are part of a screen or not.

(c) If of a screen, the reconnoissance of the screen.

(d) The concentration of sufficient of the scouting force and support to pierce the screen to ascertain whether or not the enemy main body and train are within the screen.

(e) The tracking of the enemy main body if unopposed.

(f) Concentration of all searching ships when assured that the enemy main body is located.

(g) Scouting in such a manner that the enemy main body can not escape detection in case it attempts to leave the vicinity of the screen.

The last item is one which requires special attention. If the enemy is heavily screened, it is unwise to attempt to maintain contact after dark, for such scouts as remain in the vicinity of the screen near dark will fall an easy prey to the enemy destroyers.

The usual procedure near dark is as follows:

(a) Attempt to get the location of the enemy main force about two hours before sunset.

(b) If it is impossible to get contact with the enemy main force, have scouts close on the screen from all sides in order to develop the contour of the screen.

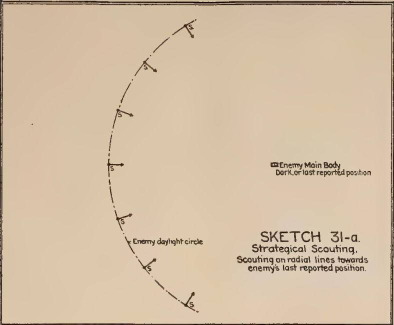
(c) From the best information at hand, decide the approximate location of the enemy main body at the time of the latest observation. Use this point as a center for an arc upon which the scouts should be formed at daylight. The radius of the arc should be great enough to assure that the scouts will not find themselves within the enemy screen at daylight; it should therefore not be less than the distance the enemy could steam from the hour of the latest observation until daylight, plus the radius of the screen, plus a factor of safety for errors in calculation of the enemy's position, inaccurate navigation, and possible error in the assumed enemy speed. In making this calculation, it is usually advisable to use a speed for the enemy near his maximum, as there is no assurance that he will not use maximum speed during the night.

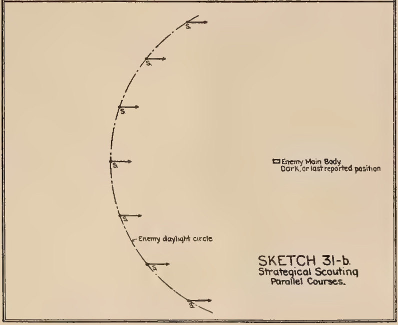
The usual formation for the scouting line at daylight following a contact is on the arc of a circle. The portion of the arc is, of course, dependent upon the probable course of action of the enemy. If the number of scouts available is large, the distance between the scouts in the enemy's most probable area should be small.

It may happen that several portions of the arc will have to be covered, leaving a wide gap between the groups of scouts. The situation, as it is presented by the information of the enemy's probable intentions, of one's own force, and the general situation, must be thoroughly considered before making a decision as to the portion of the arc to be covered.

Having formed the line on the arc of the circle, as above described, there are several methods of using the scouts during the succeeding daylight which will be discussed.

1. If it is believed that with the scouts placed at a distance not in excess of twice the radius of visibility, the arc covered by the scouts is sufficiently great to cover any probable change of course by the enemy, the scouts may be directed to steam toward the enemy's last reported position on radii from their daylight position. This method should cause an early contact with the enemy and tends to concentrate the scouting force while scouting. This is a direct method.





26051—16. (Face p. 189.) No. 1.

Any fixed point may be designated as the point for which the scouts are to steer (Sketch 31–a).

2. If it is believed that steaming on the radii would reduce the area scouted to too small an amount, the scouts may be directed to steam on parallel courses such that the center scout will pass through the enemy's last reported position. Direct method (Sketch 31–b).

Both of these methods will be unsuccessful if the enemy has made a decided change in course, but they are effective if the enemy has maintained approximately the same course but reduced his speed materially. They should be considered when the conditions are such that a change in the enemy's speed is more probable than a change in his course.

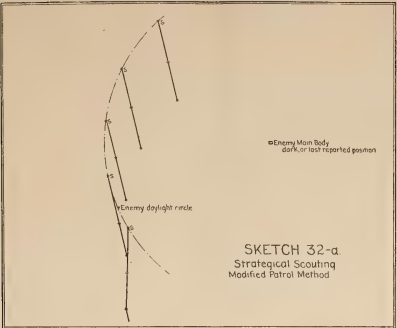
3. When, with the scouts at a distance not in excess of twice the radius of visibility, the arc covered by the scouts at daylight is so small that a material change in course by the enemy would cause him to pass outside of the area covered, it will be necessary for the scouts to use some form of the retiring search. In this case, the line should be formed as far to one flank as is consistent with the necessity of covering the other flank by dark of the day following, and the retiring search run toward the unguarded flank.

The patrol method is one of the most effcient methods, for the scouts can be spaced at a maximum distance and the arc is covered at its center for a wide variation in speed.

A modification of this method can sometimes be used to advantage, as follows: The flank scout runs the retiring search, but the other ships are given a course such that the second ship cuts inside the search curve, but not so much that an enemy force could pass undetected; the other ships steam on a course parallel to that of the second ship, which has the effect of moving the area searched toward the last reported position of the enemy (Sketch 32–a).

In using this method, scouts should not be placed at a distance much in excess of twice the radius of visibility.

4. It may happen that with a very few scouts the patrol method will not be efficient for such reduction in speed as is considered probable for the enemy. In this case the scouts may be formed on the daylight maximum speed circle at a distance not in excess of twice the radius of visibility, and directed to search by the retiring search independent method. In order to reach the meeting point for the assumed speed of the enemy, all ships except the one assuming the enemy's maximum speed will, at daylight, steam directly toward the enemy's last reported position until each arrives at the meeting point for the assumed enemy speed, then start the retiring search on the assumption given (Sketch 32–b).



SKETCH 32-a.
Strategical Scouting
Modified Patrol Method

SKETCH 32-b
Strategical Scouting
Independent Method

TRACKING AFTER ENEMY MAIN BODY IS KNOWN TO BE INSIDE OF THE SCREEN.

In tracking the enemy under this condition during daylight, when the enemy is active in driving off scouts, it may often be advisable to form a circle of scouts outside of the enemy's screen. It is advisable to have the greatest number of scouts in the area other than that which will be covered by the enemy if he maintains the course and speed of the screen, for, if the enemy attempts to change course during daylight, he may permit his screen to proceed on the original course in order to mislead the scouts.

In carrying out this method, the scouts forming the circle should be kept out of sight of the enemy's screen so that their presence may not become known. The negative information, which can be acquired in this way, is almost as valuable as positive information, and is less expensive. The enemy's main body must have been once located within the screen before this method can be considered efficient.

To illustrate these methods of strategical scouting, several examples, which have occurred in maneuvers, will be given:

1. Scouting on radial lines toward a fixed position. Sketch 33(a).

This example is taken from the department strategical problem No. 1.

Situation.—A Black force, superior to Blue, is approaching the Blue coast with the mission to seize and establish an advance base between HATTERAS and EASTPORT, ME.

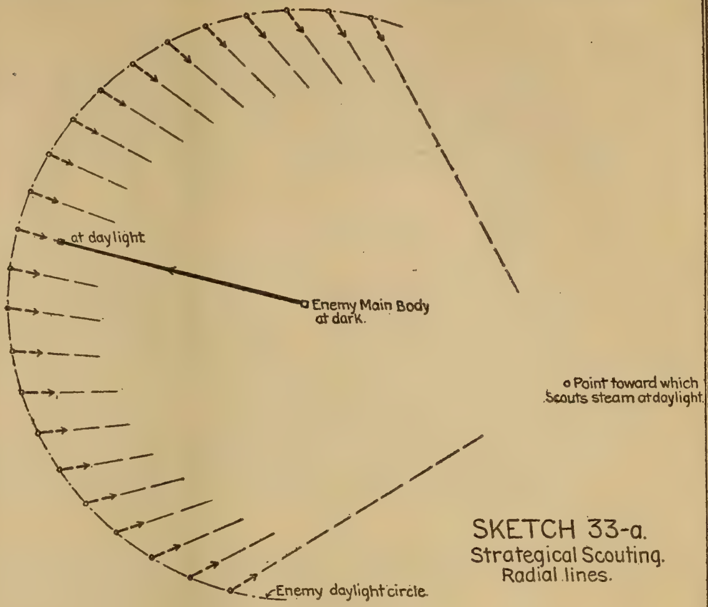
Black advanced a strong offensive screen of scouts and cruisers supported by armored cruisers and battle cruisers. This screen encountered Blue scouting detachments and drove them back upon their supports, destroying numerous Blue scouts in the operation.

The Blue supports, dreadnaughts, later retired upon the Blue main body and destroyers which had advanced from NEWPORT to the eastward at 16 knots.

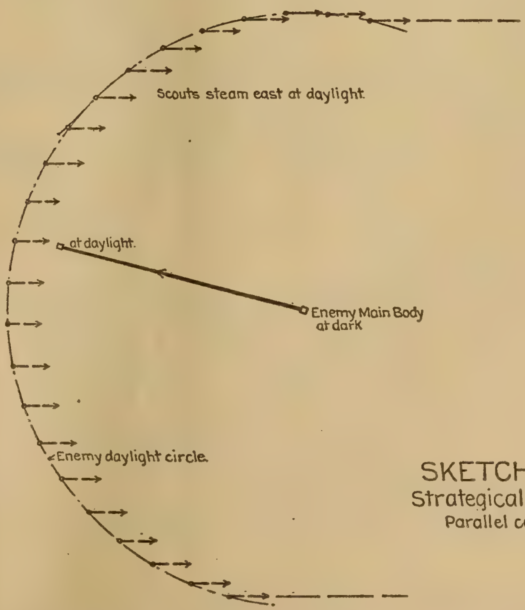
By 3 P. M. the concentrated Blue force changed course to about WNW, and proceeded on this course until dark. The Black scouts and battle cruisers followed Blue's detached ships toward the point of concentration and tracked the Blue main body until dark.

The position of the Blue main body, so far to the eastward, seemed to warrant Black in assuming that a destroyer attack could be successfully made against the Blue main body. The Black screening force commander requested that his mission be changed from that of screening to that of scouting, and his request was granted.

Believing that the Blue force would continue its westerly movement during the night, the Black scouting-force commander formed his force on a circle, the center of which was the enemy's dark position, and radius the distance the enemy could steam during the



SKETCH 33-a.
Strategical Scouting.
Radial lines.



SKETCH 33-b.
Strategical Scouting
Parallel courses

night at 18 knots. As the number of ships of the scouting force was large, the scouting-force commander directed that at 4 A. M. (daylight) the scouting force steam on radial lines toward a designated position to the eastward of the Blue dark position.

The Sketch indicates the dark position of Blue and the daylight positions of the Black scouting force and Blue main body. The dotted lines represent the courses of the scouts at daylight as directed.

The smoke of the Blue main body was sighted at daylight and the search discontinued.

2. Had the Black scouting-force commander considered the area covered by radial courses too small, the ships could have searched on course east, thus increasing the area as indicated in Sketch 33 (b).

3. Use of patrol method in strategical scouting. Sketch 34 (a).

This example of the use of the patrol method in strategical scouting occurred in the following situation:

A Black force of 6 battleships escorting 10 transports containing 10,000 troops sailed 1 December from CARIACO. Blue assumed the destination of this Black force to be SAMANA, GUANTANAMO, or COLON.

The Blue force consisted of 8 battleships, 6 merchant scouts, and 2 divisions of submarines. The submarines were disposed as follows: One division north of HAITI proceeding toward SAMANA, to arrive by 3 December, 1 P. M. One division en route KEY WEST to GUANTANAMO, to arrive 4 December, 4 P. M.

The Blue main body was operating to deny any of the above-named ports to the enemy until the arrival of the submarines at their respective destinations should make the port secure.

On 2 December the Blue scouts gained touch with the Black force and tracked it for some hours, after which they were driven off by the Black battleships. BLACK

The position of the ~~Red~~ force at 4 P. M. is shown in the Sketch.

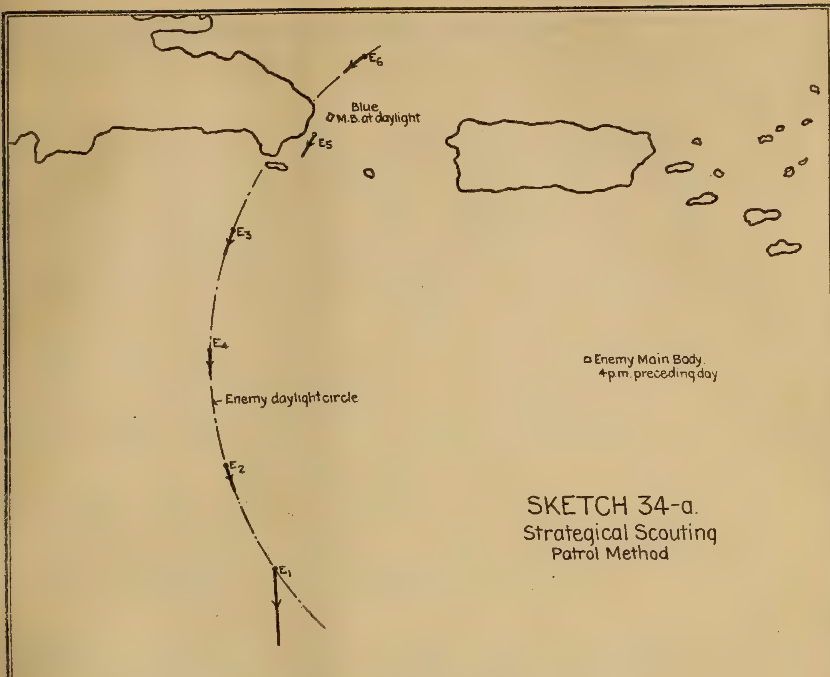
The Blue commander decided:

To occupy a position with the Blue main body in MONA PASSAGE, from which, starting at daylight, he could beat the Black force to any one of the ports assumed as a probable destination.

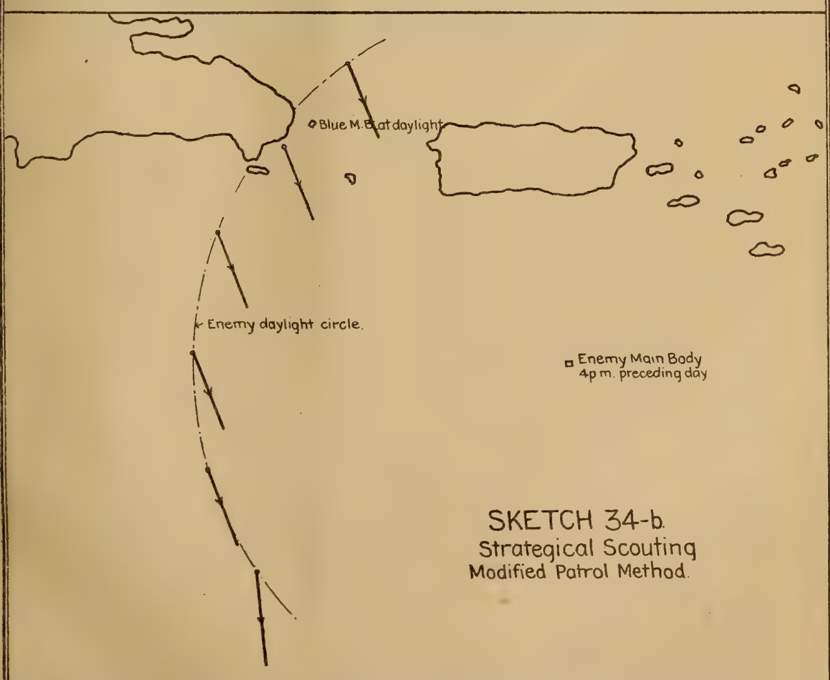
To form the scouts on the arc of a circle, the center of which was the enemy's last-reported position, and radius the distance the enemy could steam during darkness at its maximum speed.

At 6 A. M. (daylight) the scouts were to scout to the southward by patrol method, using the position of the southern scout as a point of origin.

The projected search is indicated in Sketch 34 (a).



SKETCH 34-a.
Strategical Scouting
Patrol Method



SKETCH 34-b.
Strategical Scouting
Modified Patrol Method.

26051—16——13

4. Modified patrol search.

If it had been desired to search farther to the eastward this search could have been modified by all scouts steaming as indicated in Sketch 34 (b).

5. Use of independent method.

The position of the forces at dark is shown in Sketch 35 (a). The scouts are Black. The armored cruisers and main force Blue.

The Black scout commander estimated the situation and concluded that the smoke was from a detachment of the Blue main body acting under instructions to intercept and destroy the Black convoy.

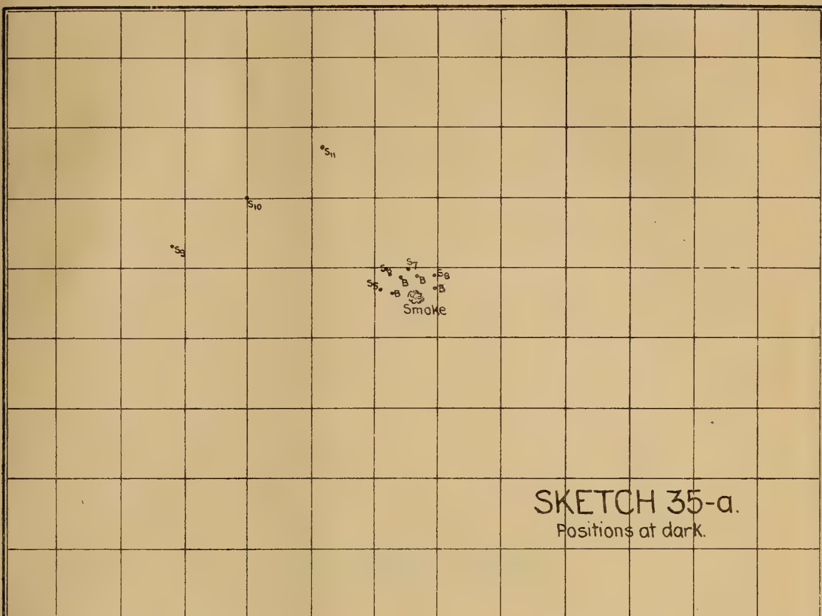
His decision was:

Decision.—1. Division 13 to form on 19-knot position circle and to cover arc from bearing 120° to westward for speeds 19–13. Three scouts to search to westward for estimated enemy speeds, 17, 15, 13. Eastern scout to search to eastward, estimated enemy speed 17, returning to westward for enemy assumed speed, 13.

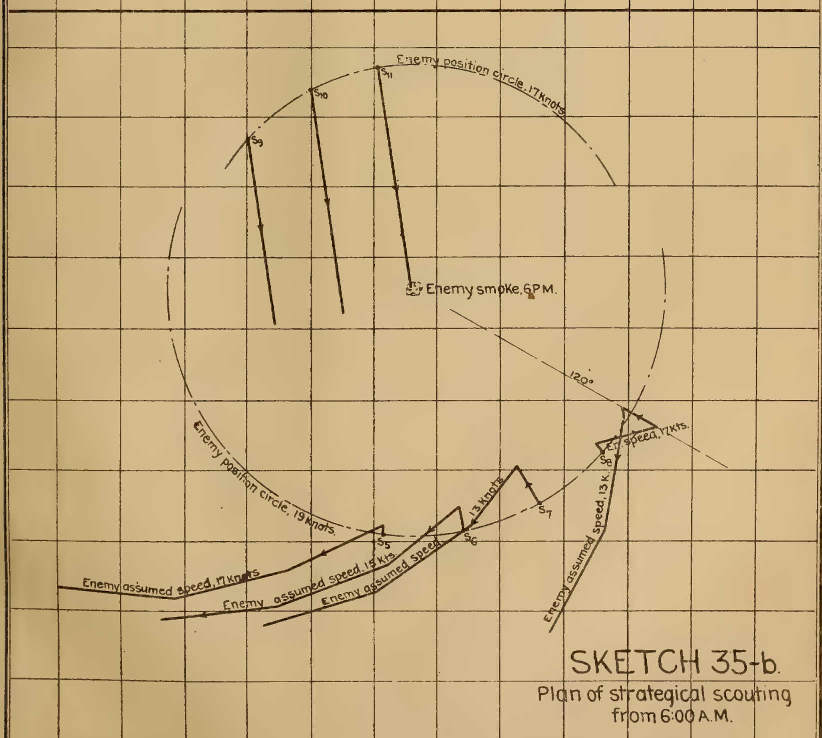
2. Division 14 to cover arc for probable courses of Blue retirement. Assume enemy's maximum speed 17 knots, allow for reduced speed or delay in northern movement by searching to southward.

The search as planned would have been as indicated in Sketch 35(b).

It will be noticed that the southern group of scouts is using the independent method and the northern group a direct method.



SKETCH 35-a.
Positions at dark.



SKETCH 35-b.
Plan of strategical scouting
from 6:00 A.M.

CHAPTER XIX.

TACTICAL SCOUTING.

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TACTICAL SCOUTING.

The second type of contact scouting is called tactical scouting. It is defined as follows:

Tactical scouting.—Operations when the main force, or other force detailed to attack, is within striking distance, to obtain constant information of the location of the enemy's main force, its strength and disposition; upon the information thus obtained are based the later offensive tactical operations of the attacking force.

Upon the information obtained by tactical scouting the commander bases the operations of coming up with the enemy and decides how to dispose his force for the attack. "The idea of tactical scouting arises from the natural wants of the aggressor who wishes to force his adversary to battle."

An historical example of tactical scouting is seen in the operations of the Japanese cruisers before the battle of TSUSHIMA.

The cruisers "gaining touch early in the morning were able to track the enemy and furnish to Admiral Togo complete information of the progress of the Russian fleet, its formation, course, speed, disposition of the train, and all other information that the admiral required for a complete consideration of his plan."

On account of the independence of the steam vessel in respect to wind and sea, the considerable increase in the radius of action of modern ships, and the introduction of radiotelegraphy, the field of operations and that of battle have augmented considerably in extent. Another factor is the fact that commanders, having at hand more and more perfect weapons, are led to contemplate operations on a larger scale.

The destroyers, which a few years ago could not act at a distance of more than several hundred miles from a base, can now act at a distance of from 1,000 to 2,000 miles. Tactical scouting in its first phase will usually be for the benefit of the destroyers, to give them information upon which they can base their plan for attack on the enemy main body before their main own body is brought to action. Such an attack, if successful, will, besides the actual damage done to materiél, have a demoralizing effect on the morale of the fleet attacked.

The use of major ships in the offensive or protective screen of a force accompanied by a large train, moving within a theater of operations, makes it imperative to use major ships to obtain the constant

information that will be required for a successful destroyer attack. Such procedure, no doubt, appears dangerous, and some major ships will probably be lost, but if the destroyer attack can be forced home by this means it may be a judicious expenditure of these ships.

Major ships should not approach a protective screen until it has been reconnoitered by lighter ships, and when they do approach the screen they should be accompanied by destroyers. There are two reasons for having the destroyers near at hand:

1. If the major ships are unsuccessful in gaining the desired information they will probably be followed by the enemy destroyers as they retire, and their own destroyers will act as a screen through which they can pass and brush off the enemy destroyers. This must be done in daylight as destroyers are not efficient as a screen against destroyers at night.

2. If the major ships are successful in gaining the desired information of the enemy main body the destroyers should be at hand to attack immediately after dark.

Few rules can be given for tactical scouting; no one has had sufficient experience either on the game board or at sea to be considered an authority. From experience obtained on the game board the following general principles seem to be well founded:

1. The screen must be developed by cruisers or scouts before major ships should be exposed in the vicinity of the screen.

2. The weakest part of the screen should be attacked.

3. The major ships should be accompanied by a very strong force of destroyers, probably all that are available.

4. The major ships should be concentrated; single ships have little chance of getting through the screen.

5. The attempt to get the information should be made early enough to permit the major ships to retire well away from the enemy screen by dark, in case they are not successful in getting the desired information.

A second phase of tactical scouting appears just before a major engagement. Strong, fast ships can approach the enemy and make observations of his formation in sufficient time to permit their own main body to take up the desired battle formation before being sighted.

The enlargement of the field of battle due to long ranges, large fleets, and high speed, has made it impossible for one eye to contemplate the entire field of battle. Fast scouts can afford much assistance to the commander in chief by watching the movements of enemy destroyers, mine layers, and submarines.

The following example will show the method of tactical scouting at night for the benefit of destroyers. Scouts must often sacrifice themselves to obtain the desired information.

SITUATION.

War exists between Red and Blue.

A Red fleet, superior to Blue in all types of vessels except submarines, is approaching the ATLANTIC coast. The Blue fleet, due to its lack of proper information service, has been forced to retire to the CAPE COD region with the idea of denying that area to Red as a base of operations for an accompanying military expedition.

Red scouts have been in touch with the Blue fleet for several days, but on this day, 19 May, fog has prevented observation.

Blue knows that the Red destroyers are in the vicinity.

During the afternoon, Blue armored cruisers and destroyers, scouting to the southward and eastward, encountered strong Red scouting forces and were forced to retire toward CAPE COD.

Special situation.—At 7 P. M. the situation was as indicated in Sketch 36.

Blue: The Blue main body was off CAPE ANN, standing north-northeast at 8 knots.

A group of five Blue destroyers, supported by one armored cruiser and one merchant scout, was patrolling off CAPE ANN.

A similar force was patrolling off CAPE COD.

Red: The Red scouting force of scouts, protected and armored cruisers, was approaching CAPE COD BAY with the idea of scouting at night to locate the Blue main body, in order that the Red destroyers might get in an attack.

The Red destroyers are in line of bearing off CAPE COD. Line 260°, distance 1 mile.

C–3, *B–6*, *S–6*, *B–4* were ordered to search the northern half of CAPE COD BAY.

S–2, *B–5*, *B–2*, *S–17* were ordered to search the southern half of CAPE COD BAY.

C–4 and *C–5* were ordered to search to the northward of CAPE ANN.

The Red destroyers were ordered to search toward CAPE ANN, then to southward, covering CAPE COD BAY.

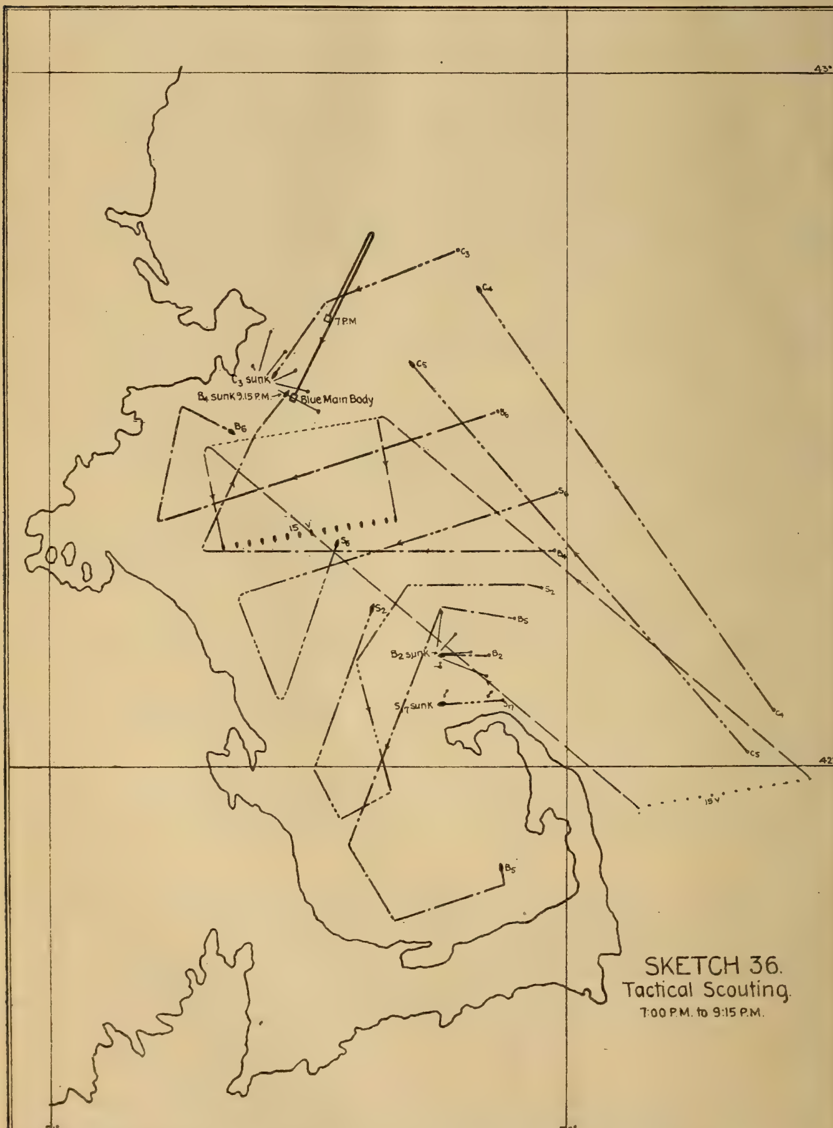
Operations.—At 7.05 P. M. a Red scout (*S–17*), passing close to CAPE COD, was sighted by the Blue destroyers and the armored cruiser and, after sinking one Blue destroyer, was herself sunk by the armored cruiser.

At 7.10 P. M., a Red armored cruiser (*B–2*), passing close to CAPE COD, was sunk by the Blue armored cruiser and destroyers.

At 8.00 P. M. the Blue main body reversed course, bound for BOSTON, and took up a speed of 12 knots.

At 8.05 P. M., a Red protected cruiser (*C–3*), passing near to CAPE ANN, was sunk by a Blue armored cruiser.

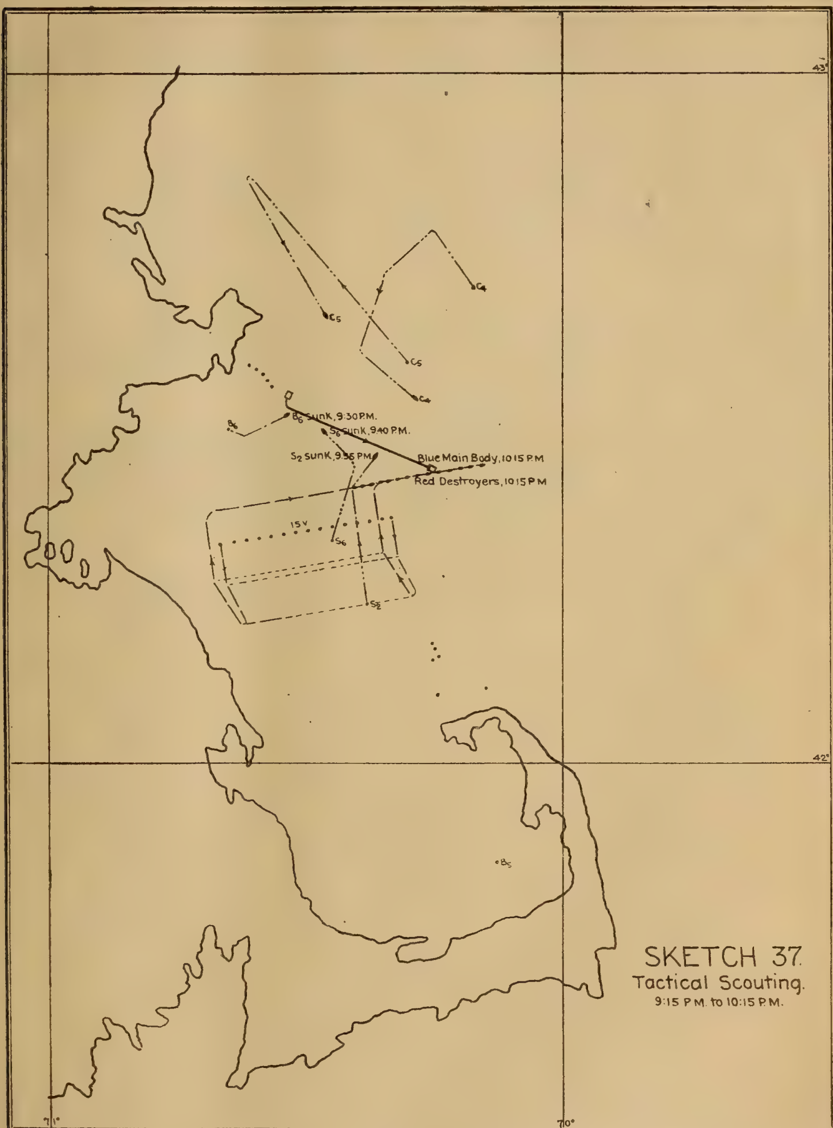
At 9 P. M., the Red destroyers had reached a position near CAPE ANN and changed course to the southward to search through the bay. They had seen the flashes of the guns during the engagement of the Blue armored cruiser and the Red scout but could tell that the number



of ships engaged was small, and, as no report of sighting the Blue main body was received, the destroyers continued to the southward.

No further contacts were made until 9.15 P. M. At 9.15 P. M., Red armored cruiser (*B–4*) sighted the Blue main body and was

sunk, but not until she had succeeded in sending a radio message to the effect that she had sighted the Blue main body. At this time the situation was as indicated in Sketch 37.



SKETCH 37.
Tactical Scouting.
9:15 P.M. to 10:15 P.M.

At 9.25 p. m., the Blue main body changed course to east-southeast and took up a speed of 15 knots.

Upon receipt of the information of the position of the Blue main body, the remaining Red scouting ships changed course toward the point of contact.

At 9.30 P. M., Red cruiser (*B–6*) was sunk by the Blue main body.

The course of the Red destroyers was changed at 9.35 P. M. to north-northwest. This course was set well to the westward to pick up the Blue main body if heading for BOSTON.

At 9.40 P. M., a Red scout (*S–6*) was sunk by the Blue main body. The position of this contact indicated that Blue was not bound for BOSTON, and the course of the destroyers was changed to the northward.

At 9.55 P. M., a Red scout (*S–2*) was sunk by the Blue main body. The Red destroyer commander now had good information of the direction of movement of the Blue main body and, by changing course to the eastward, was able to attain a position ahead of the Blue main body.

In this example is seen the proper use of scouting ships to obtain definite continuous information for the benefit of a force detailed to attack. If the attack is to be forced home, the sacrifice of many scouting ships may be a necessity.

Had the Red destroyers not been close enough to take advantage of the information gained by the scouting ships, the sacrifice of scouting ships would not have been justified; in fact, the scouting ships should have been withdrawn near dark.

CHAPTER XX.

NIGHT SEARCH BY DESTROYERS.

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Meeting points have been discussed in previous chapters, as has the locus of successive meeting points, known as the retiring search curve. There is, however, another curve which is of importance in search problems, especially night search by destroyers; it is called the meeting curve.

The meeting curve is the locus of meeting points for two forces moving from known positions, at known times of departure, on straight courses, at fixed speeds.

The curve differs from the search curve in that it is the locus of first meeting points; whereas the search curve is the locus of successive meeting points.

Four cases will indicate the method of construction of the meeting curves.

MEETING CURVES.

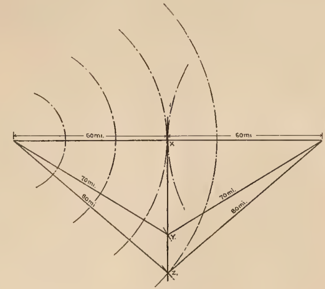
CASE I. SIMULTANEOUS DEPARTURE, SPEEDS EQUAL.

In Sketch 38, A and B represent two positions, 120 miles apart, occupied by the two forces at a fixed time. If these forces desire to meet at the earliest moment, each would steam directly toward the position occupied by the other.

Assuming that each force set course to pass through the position occupied by the other force, and that each force left its position at the same moment at a speed of 20 knots, they would meet 3 hours later at point X. This point is the earliest "meeting point."

Now let us assume that the force from A, instead of setting a course for B, took the course AY. The force from B would not meet unless it took a course BY. If it did take course BY, the two forces would meet at Y, equally distant from A and B. The time of meeting would be $70 \div 20 = 3\frac{1}{2}$ hours after departure. If the course of the force from A had been AZ, the force from B, to meet force A, would have had to take course BZ. The time of meeting would have been $80 \div 20 = 4$ hours after departure.

Each of the points X, Y, Z is a meeting point under the assumed conditions of simultaneous departure and equal speeds.



SKETCH 38.
Meeting Curve.
Simultaneous departure, speeds equal.

The line joining X, Y, and Z is the meeting curve. In the case above, simultaneous departure and equal speeds, this locus of meeting points is a straight line.

CASE II. TIMES OF DEPARTURE DIFFERENT, BUT FIXED. SPEEDS EQUAL.

In Sketch 39 (a), A and B represent the points of departure.

The force from A leaves one hour previous to the departure of the force from B. The speeds are equal, 20 knots.

At the end of the first hour the force from A may be at any point on the circle 1. If steaming toward the earliest meeting point, it would at this time be at point C.

If the force from B departs at this instant and heads toward A, the two forces will meet at X.

Had the force from A steamed on course AY, the force from B must steam on course BY to meet.

The curve X, Y, Z is the meeting curve. It is no longer straight.

The curvature is toward the point of departure of the force which departed at the latest hour.

CASE III. SIMULTANEOUS DEPARTURE. SPEEDS UNEQUAL.

In Sketch 39 (b), the speed of the A force is to the speed of the B force as 2 to 1. The meeting points are the intersections of simultaneous position circles.

In this case XYZ, the meeting curve, is the arc of a circle, the center of which is on the line AB prolonged in extension of B.

CASE IV. DIFFERENT TIMES OF DEPARTURE—DIFFERENT SPEEDS.

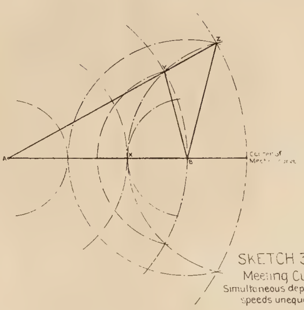
In Sketch 40 (a), the force A, speed one-half that of force B, left at such a time that it could steam the distance AC before B force departed. At a time several hours later force A could have steamed AX. By this same time force B could have steamed BX. X is the earliest meeting point. Y and Y′ are meeting points, assuming the course of A force to be AY or AY′. Y′XY is the meeting curve. This locus for this position is nearly straight, for the early departure of force A has offset its slow speed; the meeting curve, if continued, would curve toward point A.

SEARCH OPERATIONS BY DESTROYERS.

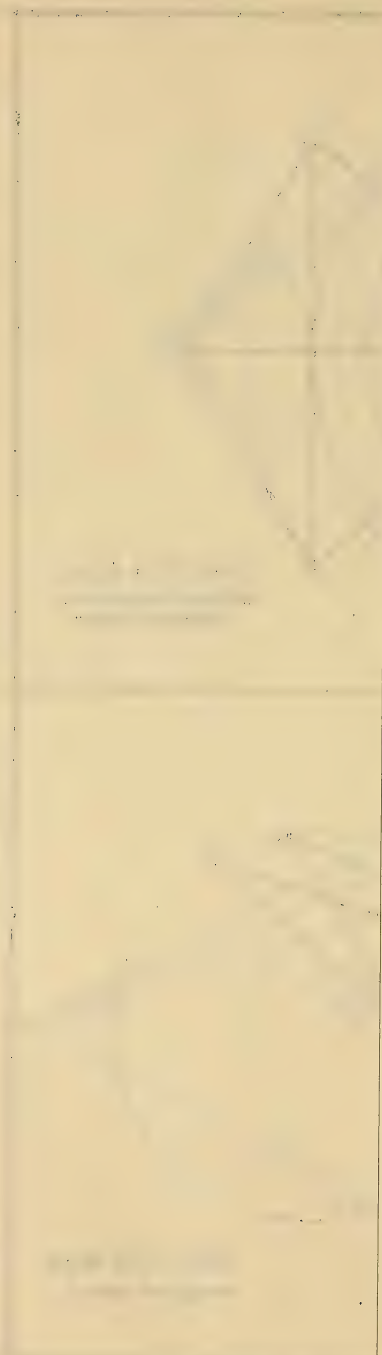
In search operations by destroyers it is very important that no energy be expended in searching an area which could not have been reached by the enemy. The destroyers must concentrate for an effective attack, and therefore the dispersion for search should cover as small an area as is consistent with locating the enemy.

It is in the selection of this area of search that the meeting curve is of use.

SKETCH 39-a
Meeting Curve
Different departure, speeds equal



SKETCH 39-b
Meeting Curve
Simultaneous departure speeds unequal



In Sketch 40 (b), let D be the position from which the destroyers start the search.

M the position of the enemy main body at the time the search is started.

E F G H I the meeting curve (simultaneous departure, unequal speeds).

E the meeting point for courses DE—ME.

H the meeting point for courses DH—MH.

In the sketch it is seen that the angle θ contains all the courses from D, which would meet the enemy main body moving from M under the assumed condition of simultaneous departure and unequal speeds. Speed ratio 2:1.

Any search conducted outside the angle θ is wasted.

To use destroyers for distant search operations, when any suitable vessels are available, is a fundamental error in any plan. They are not suitable for the purpose, and the usual result is the disablement of the destroyer, or the exhaustion of the destroyers' fuel and personnel to such an extent as to greatly reduce their efficiency for their legitimate work, the attack upon the enemy's major ships.

In making an attack on the enemy main body, however, it is often necessary to make a night search with the destroyers in order to locate the object of attack. The assumptions upon which this search is made are the enemy's position, course and speed at or near dark, or at some known time during the night.

The area selected for search operations is influenced by the following known or assumed conditions:

1. Position of enemy at some previous time. The shorter the time interval the better.

2. The constitution and disposition of the enemy forces. This data should furnish a basis for assuming the enemy's speed, formation, and course of action.

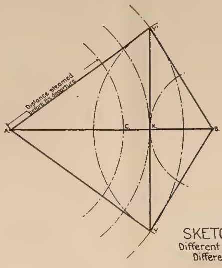
3. His probable objective. This, if known, will greatly reduce the area to be searched.

The most usual case, and one which will indicate the general use of the meeting curve, will be somewhat as follows:

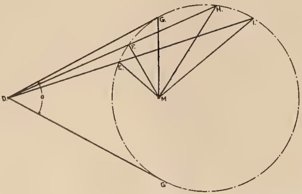
The enemy main body being tracked by fast scouts or battle cruisers is reported to be, at dark, in a certain position, approximate course and speed as indicated. The destroyers are, say, 50 miles in advance of the enemy main body at dark.

The scouts and battle cruisers can not keep touch after dark, so the attacking destroyers must be disposed, if possible, so as to make contact with the enemy, no matter how his course and speed may be changed at or after dark.

It is in this connection, deciding upon the area to be searched by the destroyers, that the meeting curves are useful.



SKETCH 40-a.
Different departure
Different speeds



SKETCH 40-b.
Angle of search.

26051—16. (Face p. 209.)

In Sketch 41 (a), let M be the position of the enemy main body at 7 P. M.

Let D be the position of the destroyers at 7 P. M.

Assuming enemy main body speed 15 knots and destroyers 25 knots, how may the search be conducted to assure contact no matter what change of course and speed may be made by the enemy main body?

Assuming D the position of the destroyers at 7 P. M. and M the position of the enemy main body at 7 P. M., we construct the meeting curve. C, E, F, which, as we have seen for simultaneous departure, different speeds, is a circle the center of which is in the line D M prolonged beyond the position of the slower force, or at point O.

The tangents to this meeting curve from point D show the limits within which search is profitable. Search outside of this area is wasted energy, for the enemy could not be there at the time destroyers are, if, as assumed, the destroyers search at 25 knots speed.

In Sketch 41 (a) the paths of 10 destroyers have been drawn on the assumption that the enemy probably would change course to the northward at dark. The enemy will be discovered if his course from dark lies within the angle α.

Sketch 41 (b) shows 10 destroyers searching on the supposition that there will be no great change of course by the enemy main body.

In each of these cases it is seen that the number of destroyers assumed (10) is really insufficient to cover an area such as might be required to be sure of locating the enemy main body under the assumed conditions, which conditions are really very good.

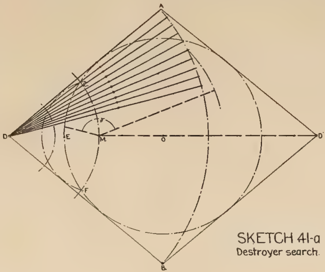
If the information is delayed, the area to be covered to assure success becomes greater, and, consequently, more destroyers are required to make a complete search.

As an example: At 8 P. M. the destroyer flotilla at D learns that at 7 P. M. the enemy main body was at position M. Distance D M=50 miles.

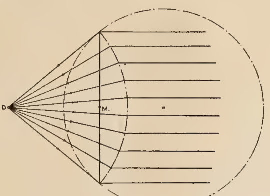
In Sketch 42 (a) it will be noticed that the distance from D to M is the same as in the previous example and, assuming the destroyers stopped at D from 7 P. M. to 8 P. M., it is shown that late information increases the angle through which the search must be conducted.

The angle θ is much greater than in the previous example where the destroyers started at 7 P. M.

The situation generally encountered in night search and attack is incapable of complete solution by one search operation unless the number of destroyers is large. Even if the number of boats was sufficient to complete the search, it is probable that the dispersion for search operations would prevent a concentration of all boats for the purpose of attack.



SKETCH 41-a
Destroyer search.



SKETCH 41-b
Destroyer search.

It is necessary, therefore, to limit the area of search to one within which, if the search proves successful, enough boats can be concentrated to make the attack effective.

In actual war there may be many conditions affecting the enemy that reduce the possible courses which he may take; all information that appears to limit his operations should be given full consideration.

The usual situation may be considered somewhat like this (Sketch 42-b):

A destroyer flotilla of 20 boats at D learns at 8 P. M. that the enemy main body was at 7 P. M. in position M, speed 15, course for G, where the enemy main body can find shelter. How will the flotilla search in order to have the greatest chance of making a successful attack? Destroyer speed, 25; enemy main body speed, 15.

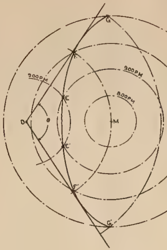
It is not probable that the enemy main body will be informed of the position of our destroyers. It is probable that the enemy main body will seek shelter in the protected port G, if it can get there. If the enemy main body steams direct for G at 15 knots, it can arrive at 2 A. M.

If the enemy steams on this course, it would be possible for our destroyers to make contact about 10.30 P. M. The time in which the destroyers would have to concentrate and attack would be but $3\frac{1}{2}$ hours. In $3\frac{1}{2}$ hours the destroyers can gain, at 25 knots, on the enemy main body but 35 miles. In order to be sure that all boats may attack, the scouting line must not be over 35 miles in length.

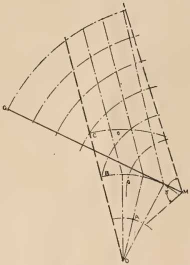
It is not desirable to use more boats for search than are required to cover the area. As many as possible should be held concentrated for the attack, thus avoiding the delay and confusion incident to concentration after location of the enemy.

In the above case, 10 boats would be used for the search, the base course being the tangent to the meeting curve. The other courses for two hours would be such as to deploy to a 4-mile distance at the end of the period. The course for all boats at the end of the first two hours would be the base course.

Ten boats would be kept concentrated in rear of this line and near to the boat, covering the maximum assumed enemy's speed on the direct route to G.



SKETCH 42-a.
Destroyer search.



SKETCH 42-b.
Destroyer search.

CHAPTER XXI.

THE SERVICE OF SECURITY. OFFENSIVE SCREENING.

CHAPTER XXI

THE SERVICE OF SECURITY.

OFFENSIVE SCREENING.

Frederick the Great once said:

> It is pardonable to be defeated, but never to be taken by surprise.

> A force taken by surprise may be compared to a sleeping man attacked by a well-prepared enemy. Astonishment, confusion, and alarm are opposed to coolness, preparation, and confidence; and severe blows may be received before any can be given in return. The surprised force must possess many elements of superiority over its assailant to be able to overcome the enormous disadvantage at which it is taken; and a surprise generally means defeat.[1]

The high speed developed by modern ships of war, and especially the difference between their maximum speeds and usual cruising speeds, makes the chance of surprise attack at sea greater to-day than in the past.

The efficiency of the torpedo, as shown by results in the European war, has made the destroyer attack more dreaded and has indicated the necessity of guarding against surprise attack from this type.

The efficiency of communication by radio facilitates communication between scouts and destroyers to such an extent that one observation by an enemy scout of the main body during daylight, may lead to its destruction at night by destroyers which, at the time of the scout's observation, were many miles away.

Security is defined in the Century Dictionary as follows: "That which secures or makes safe; protection; defense; guard."

Col. Henderson in his book, "The Art of Reconnaissance," states with regard to operations on land: "Protection implies two forces, one of which is protecting the other; measures of security refer to the precautions which any one force takes to guard itself from surprise or observation."

In land operations, then, strong advance guards and screens are referred to as protective forces; while outposts and smaller detachments, such as flank or rear guards, are parts of the service of security.

Available roads and difficulties of terrain often, in land operations, so limit the direction of approach of the enemy in strength; the ter-

[1] Furse: "Information in war."

rain so increases the value of the defensive; and the time required for the enemy to take up battle formation so delays his advance; that protective forces, as above defined, are of much greater assistance to the main force on land than similar forces can be at sea.

At sea we have no terrain to aid us in defense or in concealing the composition and strength of the protective force; no roads or terrain limit the direction of approach. The mobility of naval forces is so great compared to the area that can be thoroughly covered that, in a naval operation, protective forces, except the offensive screen, should be considered as of the nature of outposts, i. e., service of security.

Security from observation, which, with the exception of the defense against torpedo craft, may in a naval sense be considered protection, may be afforded by one or more of the following methods:

1. By destroying or containing the enemy's information service (scouting forces).

2. By denying information to the enemy's scouting forces at such a distance from the main force that its exact location can not be determined.

3. By furnishing the main force such information of the enemy's forces that it will be enabled to avoid them by maneuvering.

The first method is essentially offensive, though the operation of the main force may be tactically defensive.

The second method may be considered passive, though the operation of the main force is usually a tactical defensive.

The third form is essentially defensive, being designed to guard against surprise attack or unknown observation by the enemy, though the operation of the main force may be tactically offensive.

The first two of the above methods require strength and are consequently known as screening, whereas the last method may be accomplished without strength and is called protective scouting.

SCREENING.

The verb, to screen, is defined by the Standard Dictionary: "To separate or cut off from inconvenience, injury, or danger; to shelter; to protect; to conceal."

Fernald says: "It (anything) is screened by putting something before it, always with some purpose of protection from observation, inconvenience, attack, etc."

Both of these authorities, by their definitions, imply that a screen must have some power to resist that which it is designed to shut out; to protect against.

This indicates that such a force must have within itself, power to protect, or conceal, or shut off from danger, or it is not a screen.

In general terms, a screen in naval operations is used:

(a) To conceal a maneuver, by defeating or containing the enemy's information service (scouting force); known as "Offensive screening."

(b) To conceal the position, composition, and formation of the main force; by protecting it from observation by the enemy's scouting forces; known as "Protective screening."

(c) To defend the force screened against attack from torpedo craft; known as "Defensive screening."

OFFENSIVE SCREENING.

216

The first type of these operations, "Offensive screening," is a combination of methods (1) and (3) given on page ~~220~~, and can only be undertaken when the force available and suitable for screening is much stronger than the scouting force of the enemy immediately opposed. If, by taking the offensive against the enemy's scouting force, it can be destroyed, contained, or pushed back upon its own main body, the greatest amount of security will be given to one's own main body.

Offensive screening is defined as follows:

Operations at a distance from the main force, with a view to destroying or containing the enemy scouting force, thus affording security to one's own main force.

The mission of an offensive screen is: To destroy or contain the enemy's scouting force.

Such a mission presupposes a general knowledge of the location of the enemy scouting force or of the probable direction of approach of such force.

To be absolutely efficient, this screen must deny passage even to single ships and, therefore, requires, for an equal front, a much larger force than is required for scouting.

Successful offensive screening requires ships that are faster than any ships of the enemy scouting force, and of equal or greater strength.

The enemy scouting force must be located before it can be attacked. It is necessary, therefore, to dispose the screen in such a manner as to gain early information of the location of the enemy scouts.

Frequently, known dispositions of the enemy scouting force facilitate a decision as to the best disposition of the offensive screen; but when there is no information concerning the enemy, it is often necessary to guard against the approach of enemy scouts from all directions.

An effective offensive screen reduces the chance of any surprise attacks upon the main force, thus avoiding the grave dangers of

panic, loss of time, useless efforts, and unnecessary fatigues which the chance of such attacks impose upon the main force. It increases the morale of its own force by assuring to it the initiative, and reduces the morale of the enemy by forcing upon him a defensive attitude and by suppressing his information service.

An offensive screen, having succeeded in destroying or containing the enemy scouting force, may change its operation from that of screening to that of scouting; but, in so doing, it must be kept in mind that as long as its own main force is acting on the tactical defensive, screening operations must be resumed if the enemy's scouting force again attempts to take the initiative.

The following example is given to indicate how information of the enemy's force and disposition may assist in deciding upon the use and position of an offensive screen:

SCREENING EXERCISE 1.

(Sketch 43.)

Motives.—Study of scouting and screening operations. Attack on and protection of a convoy.

General situation.—War exists between Blue and Orange. On 26 March Blue occupied AMAMI as an advanced base, secured it against raids, and supplied it with a month's stores of coal and provisions. No stores have been received since. On 5 April the Blue fleet established a blockade of NAGASAKI and the entrance to the INLAND SEA, with the object of putting so much pressure upon the Orange country that the Orange fleet would be forced to leave its base in the PESCADORES to break the blockade, thus affording Blue an opportunity to bring on an engagement.

Blue suffered heavily in the blockade operations, but succeeded in drawing out the Orange fleet. The Blue fleet was attacked at night by the Orange destroyers and lost several ships, but on the following day fought an indecisive though severe action with the Orange fleet off SIMONOSEKI. Darkness putting a stop to the engagement, the Orange fleet retired into the INLAND SEA, the Blue fleet to AMAMI. The Orange battle cruisers and a number of second-class cruisers took no part in the major engagement, being employed in breaking the blockade of KII and BUNGO CHANNELS.

On 15 April the Blue commander in chief dispatched his entire available force, 4 dreadnaughts, 4 armored cruisers, and 4 protected cruisers, to GUAM to escort supply ships to AMAMI.

Special situations.—On 19 April, 6.30 P. M., the Blue escort and train of 10 supply ships are clearing the harbor of APRA. A tramp

steamer is in sight in the offing. At this time the escort commander receives the following radio:

AMAMI,
19 APRIL, 5 P. M.

Reliable reports, dated nineteen April, indicate that eight Orange second-class cruisers left KURE for BONIN ISLANDS midnight sixteenth/seventeenth April. Four Orange battle cruisers and fifteen destroyers at KURE will be ready for sea forenoon twenty April. No other Orange vessels known to be ready for sea.

Blue main body remains at AMAMI. Ten destroyers will be ready for sea and subject to your instructions after midnight twenty-fourth/twenty-fifth April. Must have provisions by midnight twenty-six April.

Give safe conduct to supply ships to AMAMI.

[S.] A.

Required.—Rear Admiral N's estimate of the situation.

SCREENING EXERCISE 1.

SOLUTION.

(Sketch 43.)

Mission.—To give safe conduct to the Blue supply ship to AMAMI, arriving by midnight 26 April.

Enemy forces.—Their strength, disposition, and probable intentions:

Eight Orange second-class cruisers left KURE for the BONIN ISLANDS midnight 16–17 April. The distance from KURE to COFFIN BAY is 760 miles. Assuming 17 knots speed, this force could have arrived at COFFIN BAY by 18 April, 9 P. M., and could depart, allowing 12 hours to coal, 19 April, 9 A. M. This force will probably proceed to the vicinity of GUAM to report the movements of the Blue escort and train.

If Blue steams directly toward the BONIN ISLANDS at 11 knots, and the Orange cruisers steam toward GUAM at 17 knots, the meeting time will be just before dark on 20 April. By taking a course at an angle with this line or by reducing speed slightly, Blue can be practically assured that none of the Orange cruisers will make contact during the daylight of 20 April.

The radius of action of these cruisers will not permit the continuous use of high speed; they would, therefore, probably proceed at a moderate speed until Blue is reported leaving GUAM. A contact with this force is improbable before daylight 21 April.

The Orange battle cruisers will be ready for sea at KURE the forenoon of 20 April. They will probably proceed to the BONIN ISLANDS to coal, unless they receive information of Blue's departure.

KURE 20 Apl

Assuming that they leave at 6 A. M. and, receiving information of Blue's departure, proceed at 25 knots toward the nearest possible meeting point, the meeting time will be 21 April, 8 P. M. As these conditions are the most favorable that can be assumed for Orange, it is reasonable to estimate that no contact will be made with the Orange battle cruisers during daylight 21 April.

The Orange destroyer flotilla, consisting of 15 boats, must contain several divisions of boats whose radius is not over 1,500 miles at 10 knots. To be effective, a torpedo attack should be made by a large number of boats simultaneously. Even if several large destroyers are present, they will probably be maintained in the immediate vicinity of the slower boats.

This small radius of action of the destroyers will limit these boats to a speed not much in excess of 10 knots, until the Blue force is definitely located. They, therefore, will not be in a position to be dangerous to Blue before 22 April.

From the above considerations it appears that Blue is threatened on 21 April by the second-class cruisers only; on 22 April by these and the battle cruisers; and, after dark, 22 April, by the entire Orange force.

The aim of the Orange force is undoubtedly the destruction of the Blue train and escort. This may be best accomplished by a night attack by the entire Orange force. As the destroyers will probably not be available before 22 April, Orange will endeavor to postpone the engagement until that date.

The Orange commander is aware that many Blue ships are repairing at AMAMI, and he will therefore attempt to engage as soon as possible after his entire force is available.

In order to suceed in this aim, the Orange force must locate and track the Blue convoy.

The area of operations is large in comparison with the number of Orange ships that are available for search operations. All Blue routes come to a point at AMAMI, but Orange can not delay the action until Blue reaches this vicinity, for Blue might receive such reinforcements as would make the Orange threat practically negligible.

Assuming that Orange does not desire to bring on an action before 22 April we must examine the area within which the Blue force might be at that time.

At 11 knots Blue would be at daylight, 22 April, 650 miles from GUAM. To arrive at AMAMI by dark, 26 April, Blue must at this time be within 1,200 miles of AMAMI. The arc upon which Blue might be at this time and still be within 1,200 miles of AMAMI is over 1,200 miles long. It is therefore manifestly impossible for

Orange to wait until daylight of 22 April to begin his search operations.

In order to reduce to moderate limits Blue's undetected location at daylight, 22 April, Orange must start as early as possible to eliminate possible Blue routes. The only ships available for such operation on 21 April are the second-class cruisers.

During 21 April Orange has two courses of action open to his second-class cruisers:

(a) To examine Blue's most probable area in the direction of, or to the westward of, ~~AMAMI.~~ GUAM-AMAMI line

(b) To examine his least probable area, that reached in case a detour to the northward and eastward is contemplated by Blue.

Course (a) would eliminate certain of the probable courses, but would leave areas on each side unsearched. In eliminating areas, it is preferable to start on the extreme flank, working toward the center.

In addition to the greater efficiency in the elimination of areas, course (b) gives less chance of a contact with the Blue screen. If immediate contact is desired the most probable area should be searched first, but in this case Orange should endeavor to eliminate areas by negative information until all of his force is available for action.

The Orange battle cruisers and destroyers will probably proceed direct to the earliest possible meeting point with the Blue force, until information indicates Blue's presence in another area.

In view of the inferiority of the second-class cruisers and of the delay of the Orange battle cruisers and destroyers, it seems probable that these cruisers will, on 21 April, endeavor to eliminate as many possible Blue routes to the eastward of the direct course to Amami as they can cover, hoping to be able to proceed without interference and basing their operations on the value of negative information.

Own forces.—Strength, disposition, and courses of action open to us:

On 19 April, at 6.30 P. M., the Blue escort and convoy is clearing the harbor of APRA, bound for AMAMI with supplies for the Blue fleet. These supplies are necessary to the continuance of the campaign and must be delivered by 26 April.

The tramp steamer, which was sighted in the offing as this force was leaving, may have reported our movements to the Orange cruisers.

The escort consists of 4 dreadnaughts, 4 armored cruisers, and 4 first-class cruisers. No other vessels will be able to reenforce this escort until 25 April on which date ten 28-knot destroyers at AMAMI will be placed under the instructions of the escort commander.

These destroyers can join Blue by dark 25 April at any point from which Blue train can arrive at AMAMI by midnight 26–27 April.

From the considerations of the enemy force given above, it appears that the Blue force is threatened on 21 April by the second-class cruisers only; on 22 April by these and the battle cruisers; and after dark 22 April by the entire available Orange force.

Blue's aim is to deliver the convoy intact at AMAMI by midnight 26–27 April. The successful accomplishment of this task is threatened by the strength of the Orange battle cruisers and destroyers. If Blue can evade this force, the task is simple.

Though Blue may not be able to evade the entire Orange force, it may be possible to evade the battle cruisers and destroyers if the enemy searching force, the second-class cruisers, is destroyed. The possible area within which the Blue convoy may lie at daylight 22 April is so great that Orange will have but a small chance of success if his battle cruisers only can be used for searching and the dispersion of force caused by such search will add to Blue's security even if located. The Orange destroyers have such a small radius of action that many of them at least can not be used for search operations.

There are two widely differing courses of action open to Blue:

(a) To seek to evade the enemy, maintaining the screen merely as a protective screen.

(b) To use the escort as an offensive screen, facilitating future evasion by reducing the enemy searching force.

Course (a) is essentially defensive and should only be considered if the area is so great that Blue has a good chance of proceeding to AMAMI undetected.

A study of the area that can be covered by the Orange force, if the search operations are allowed to proceed uninterruptedly, will show that Blue has little chance of avoiding the Orange force except possibly by a wide detour, or a long delay to the southeastward of GUAM. Both of these courses would cause a late arrival at AMAMI, would permit the Orange search operations to proceed without interference, and would so reduce the Blue maneuvering area for future days that, in case Blue was sighted, there would be little time available in which to out-maneuver the enemy.

A successful outcome of this plan would rest entirely upon the chance that the enemy would fail to search the route by which the Blue force was proceeding. If Orange can eliminate many of these routes by negative information, the Blue force is sure to be located and at a time and place that will offer little chance of escape.

This course must be rejected as offering too few chances of success.

Course (b) may be of a defensive-offensive nature or essentially offensive, depending upon the location of the screen.

The position of the screen on the defensive-offensive would be between the train and the direction of approach of the enemy scouts. In order to prevent a close approximation to the position of the train from that of the screen, the screen must extend over a wide front. The front can only be maintained toward the enemy if we can estimate correctly his method of search. The only time when Blue can be fairly well assured of the method of search is at daylight, 21 April, when the enemy second-class cruisers will probably be on the Blue maximum speed daylight circle and searching toward GUAM. An offensive action of the screen would result in the pushing back and possible destruction of such of the enemy scouts as made contact with the screen. If the enemy scouts were searching an area other than that covered by the screen, they would proceed uninterruptedly, eliminating many possible Blue routes by negative information and indicating Blue's presence in the other area equally as well as though the screen itself had been discovered.

If the screen is not discovered for several days, Orange could eliminate so many possible routes that Blue's actual route would be practically fixed.

Our estimate of the situation indicates that the enemy second-class cruisers only will be available for search on 21 April.

If we permit them to search without opposition, they will eliminate so many Blue routes that Blue's actual route will be fairly closely fixed by negative information.

If we use the screen offensively, we must place it where it will be most apt to meet the enemy scouts on 21 April.

This course is essentially offensive. Only two of the Orange second-class cruisers are rated higher in speed than the Blue armored cruisers and first-class cruisers. Most of them are inferior in speed and may be overtaken during daylight.

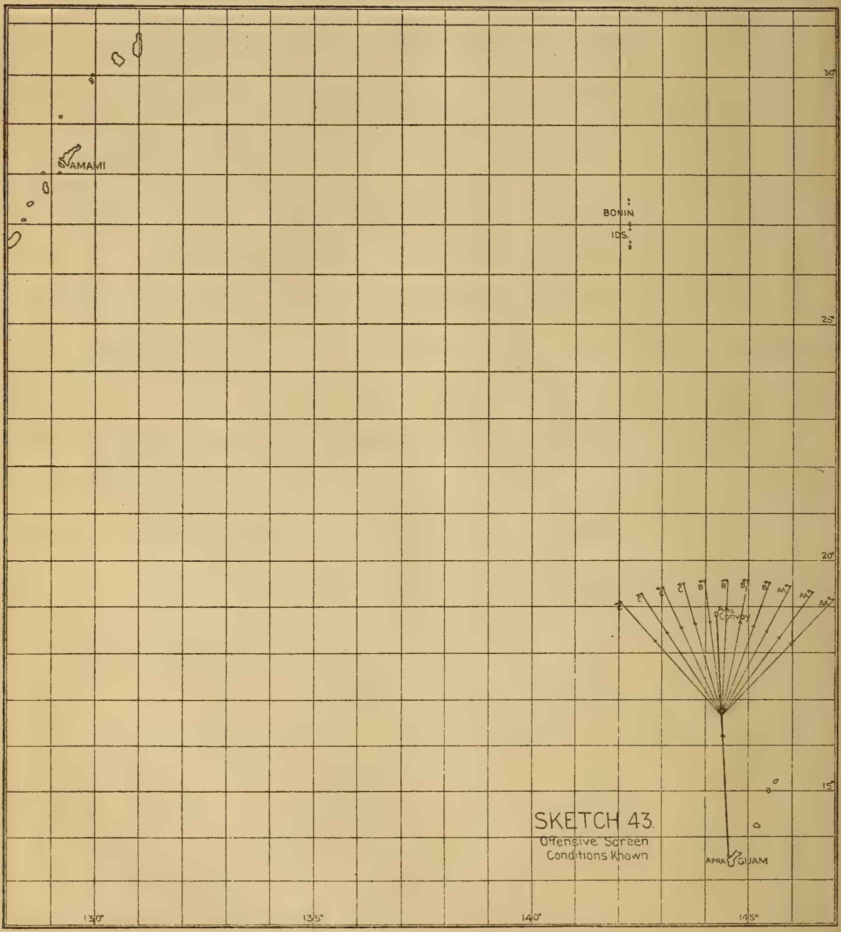
The destruction or dispersion of the Orange second-class cruiser squadron on 21 April leaves Orange no positive information of the route of the convoy. It prevents the elimination of certain Blue routes by negative information. It reduces and disperses the Orange forces and causes a readjustment of the plan of search operations. It creates in the mind of the Orange commander an uncertainty as to whether or not the Blue convoy is with the screen or proceeding by a different route. It will require the Orange commander to give up the search of a portion of the possible area or cause him to make such a wide dispersion of his force as to greatly reduce his chance of success.

To place an enemy in a position where the success of his operation imposes upon him the abandonment of the search in a possible enemy area is to gain half of a campaign where success eventually rests upon evasion. Few men can, in a position of immense respon-

sibility, put all their stakes upon a quick decision without a great deal of mental strain, the result of which is hesitancy and confusion in the execution of the decision.

Course (b), using the screen offensively, offers the greatest chance of success.

Decision.—To operate with a strong offensive screen against the Orange second-class cruisers to the eastward of the direct course to



AMAMI, proceeding with the train, lightly guarded, in rear of the screen, as near to AMAMI as conditions permit, without subjecting the train to probable discovery.

TACTICAL DECISIONS.

1. To form by daylight 21 April, a screen of 3 dreadnoughts, 4 armored cruisers, and 4 protected cruisers on the arc of a circle, center at GUAM, radius 365 miles.

2. Screen to clear a north-northeast course. Screen to steam to westward on arc of circle at daylight and, if possible, drive enemy scouts to westward.

3. To proceed with train guarded by one dreadnought to a position 40 miles inside of screen, in latitude 18° 50′, longitude 144° 20′. Train to lie to until 21 April, 7 ~~P. M.~~ A. M. at which time, if course is clear, proceed north-northeast at 11 knots.

Blue Escort,
Wyoming, Flagship,

Campaign Order
No. 1.

Lat. Fifteen fifty-five,
Long. One forty-four forty.
20 April, 8:00 A. M.

Forces:
(a) *Screen.*
Divisions Three, Eleven and Twelve.
(b) *Convoy Guard.*
Wyoming.

1. Reliable reports, dated nineteen April, indicate eight Orange second-class cruisers left KURE for BONIN ISLANDS midnight sixteenth/seventeenth April. Four Orange battle-cruisers, fifteen destroyers at KURE ready for sea forenoon twenty April. No other Orange vessels known to be ready for sea. Tramp steamer off GUAM probably reported our departure.

Blue main body remains AMAMI. Ten twenty-eight knot destroyers AMAMI subject to escort commander's instructions after midnight twenty-fourth/twenty-fifth April. Fleet needs supplies by midnight twenty-sixth/twenty-seventh April.

2. Give safe conduct to the convoy to AMAMI, operating on twenty-one April to destroy enemy second-class cruisers to facilitate future evasion.

3. (a) Screen: Divisions Three, Eleven, and Twelve operate to destroy Orange second-class cruisers. On twenty-one April, five-thirty A. M., be in position on arc of circle, center at GUAM, radius three hundred sixty-five miles, distance thirty miles, eastern ship Lat. nineteen ten, Long. one forty-seven zero five, Division Three to eastward, and steam to westward on arc at nineteen knots. Destroy enemy ships sighted. Ships not in contact with enemy at seven A. M. will concentrate on convoy.

(b) Convoy guard will, on twenty-one April, five-thirty A. M., lie to in Lat. eighteen fifty, Long. one hundred forty-four twenty to await information from screen. If no reports are received by seven A. M., will proceed on course twenty-five, speed eleven.

(x) Rendezvous Amami.

4. Convoy accompanying Wyoming.

5. Escort commander with convoy. Use one hundred fortieth meridian mean time. Cipher "C."

/s/ N,
Rear Admiral,
Commanding Blue ~~Convoy~~ Escort.

Copies to:
Commander-in-Chief
By radio.
Commanders of Divisions Three,
Eleven, Twelve.
By Guard Boat.
26051—16——15

Extract to:
Convoy Commander,
By Guard Boat.
/s/ S—, Lieut., U. S. N.,
Flag Sec'y.

The formation on 21 April, 5.30 A. M., is shown in Sketch 43.

OFFENSIVE SCREEN—NO INFORMATION.

(Sketch 44.)

If the area of operations is small and information lacking, it may be advisable to use the protective screen until the enemy makes contact, then pass to the offensive screen.

In order to examine the theory of the offensive screen on a large scale, the disposition of such a screen in a large over-sea movement will be considered.

The enemy scouting force must be located before it can be attacked. The main strength of the screen should not, therefore, be too widely separated from its own main body until the enemy scouting force is located.

An advance by the screen in strength previous to the location of the enemy scouting force might be but a blow in the air.

If the screen failed to find the enemy's scouting force, it might continue the advance in the wrong direction, thereby affording the enemy scouting force an opportunity to locate the main body without opposition.

In order to locate the enemy scouting force at a distance sufficient to permit the concentration of the screen, and attack upon the enemy scouts before some of these enemy ships can sight the smoke of the main body, it will be necessary to guard against all methods of search that might be used by the enemy, and so to arrange the screen that, if the enemy scout can not be stopped, the information from the screen will permit the main force to maneuver so that the enemy scout can not make contact during that daylight.

It is, of course, impossible to screen against unorganized scouting operations; therefore, the main force should be surrounded by a protective scouting force. In case of chance contact, this protective scouting force would notify the main force in time for it to send out a detachment of sufficient strength to deny the information, or to avoid the enemy by maneuvering.

The recognized forms of search, which must be guarded against, are:

1. Direct method.
2. Search from ahead.
3. Search from the flank.
4. Search from the rear.

To guard against the direct method from ahead requires the greatest dispersion of the screening force. In order to be sure that the enemy scouts using the direct method do not pass the screen during darkness, it is necessary to have two lines of the screen, separated at such a distance that if the enemy scouts pass the first screen line during the night, they will pass the second screen line during daylight.

Assuming that the enemy scouting force is steaming toward an assigned position, they probably will not be using a higher speed than 15 knots, unless their information is very definite. If our screen is advancing at the speed of our own main body, say 10 knots, and the hours of darkness 11, it will be necessary to have the two lines of the screen separated by a distance equal to $11 \times (10+15)$, or 275 miles.

It will not be necessary to have the advanced line of the screen cover as wide a front as the second line, for its mission is to gain information of the approach of the enemy scouts. Possibly this line may pass the enemy during the night, in which case the ships of the first line would not be in a position to aid in destroying the enemy for some hours. If the enemy scouts are encountered by the first screen line, the second screen line uses the information thus obtained to assume a position for the following daylight, such that the enemy could not have passed it even at its maximum speed.

The first line of the screen should consist of from six to nine fast scouts, disposed on a line normal to the course of the main body, in groups of not less than three scouts; the scouts of each group at such distance that no single ship could pass between them unobserved.

These scouts are called *advance scouts.*

The second line of the screen is called the *advance guard.* It should consist of a number of fast scouts sufficient to cover the desired front when spaced at such distance that no single ship could pass the line unobserved.

The advance scouts and advance guard also guard against the undetected approach of enemy scouts using the search from ahead; but, to accomplish their mission, the advance guard must be composed of ships which can defeat the enemy scouts, or else of ships so fast that they can avoid action and track the enemy scouts until such scouts can be brought to action by ships of superior power.

In addition to opposing individual scouts, it may become necessary to oppose the support of the enemy scouting line.

It is apparent, then, that the advance guard must be supported by powerful ships. These ships must also be fast enough to overhaul enemy scouts superior in power to the ships of the advance guard.

These strong, fast ships are called the *advance-guard support.* They may be concentrated in a position well in rear of the advance guard, or they may be separated, covering a front nearly equal to that covered by the advance guard.

It seems logical to keep them concentrated when it is believed that the ships of the advance guard are of equal or superior power to the enemy scouts. In this case the principal use of the support would be to oppose the support of the enemy scouting line.

When the ships of the advance guard are inferior in strength to some of the enemy scouts the advance-guard support should be separated in order to oppose such enemy scouts as early as possible.

In this second case it would be advisable to attach destroyers to the advance-guard support to attack the enemy scouting-line support after dark. The advance guard should track such support and give such information of its movements as will facilitate the attack by destroyers and, if necessary, the movement of the main force in such a direction as to avoid contact.

To guard against *search from the flank*, it will be necessary to have flank guards.

For any given conditions it is possible to determine the course that an enemy must be steering to intercept the main force, assuming the scouts to be using the retiring search, when the point of departure and own speed are known and enemy speed assumed.

Knowing own main-body speed and assuming maximum and minimum speeds of enemy scouts, the danger area can be determined. Allowing for area covered by the main body and train and a factor of safety for visibility of smoke, the length of the line to be covered by the flank guard can be determined.

To guard against *trailing*, there must be a line of the screen in rear of the main body at a distance not less than daylight run of scout minus daylight run of main body, equal to approximately 120 miles.

Sketch 44 indicates the formation as it would be used by the Black fleet under the above assumptions.

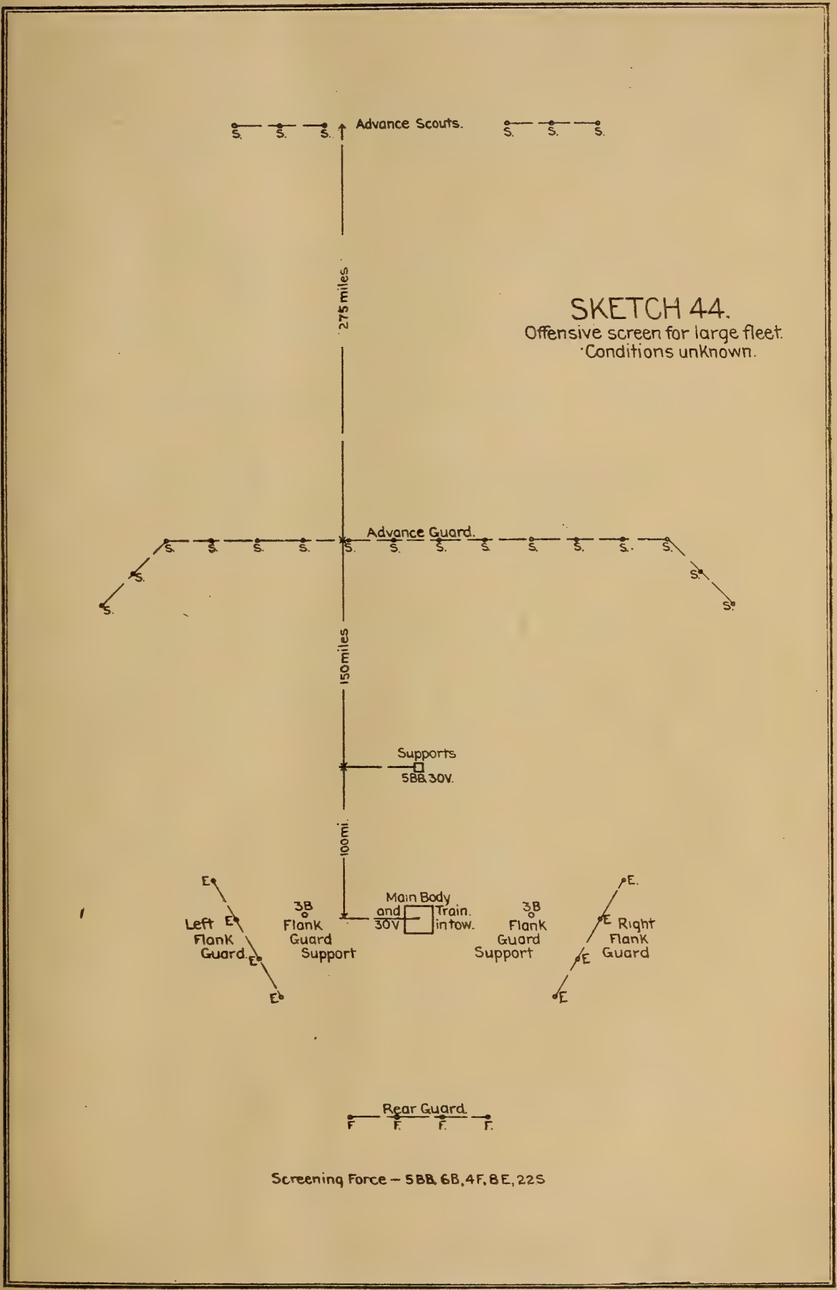
FORCES COMPOSING SCREEN.

5 battle cruisers, 6 armored cruisers, 23 scouts, 4 second-class cruisers, 8 merchant scouts.

In addition to the offensive screen, there would be required a force for "Protective scouting" and, when the area of probable destroyer attack is reached, for "Defensive screening."

TACTICS OF THE OFFENSIVE SCREEN.

The mission of the offensive screen being; *To destroy or contain the enemy scouting force*, it is clear that the tactics of the ships of this screen should be offensive.


Advance Scouts.
S. S. S. S. S. S.
275 miles
SKETCH 44.
Offensive screen for large fleet.
Conditions unknown.
Advance Guard.
S. S. S. S. S. S. S. S. S. S. S. S. S. S. S. S. S.
150 miles
Supports
5BB, 30V.
100mi.
Main Body
and 30V
Train. in tow.
3B Flank Guard Support
3B Flank Guard Support
Left Flank Guard.
Right Flank Guard
E. E. E. E.
E. E. E. E.
Rear Guard.
F. F. F. F.
Screening Force – 5BB, 6B, 4F, 8E, 22S

Speed and power are the elements of the offensive, and unless this combination is present in the screen there is little chance of success.

The battle cruiser is the most efficient type for this operation, for in itself it combines the speed of a scout with the power of a battleship. Its power can be opposed only by similar ships or battleships, and its speed permits it to decline action with battleships and will permit it in ordinary weather at sea to escape from attack by destroyers.

No nation can afford enough battle cruisers to cover effectually a front as wide as would be required for an offensive screen. Scouts must, therefore, be used to cover the area to gain the information required for the offensive tactical operation of the battle cruiser. These scouts should be fast enough to decline action with any enemy ships except of a like type, and should be so armed as to assure at least a probability of victory over like types of the enemy.

When the scouts or guards of the offensive screen have discovered the enemy scouting line, they should immediately assume the tactical offensive if of equal or superior power. If of inferior power, they should track the enemy ship until such enemy ship can be brought to action by a superior force.

A greatly superior force should be brought into each action, if possible. The ideal is to be so much superior as to crush the enemy without sustaining any damage. This condition can hardly be hoped for, but, as successful search requires dispersion, so successful screening requires concentration, and if the ships of the screen are fast enough to act together, some concentration in overpowering enemy scouts should always be possible.

The loss or injury of a ship is a greater disadvantage to the searching force than to the screening force, for the area assigned to the scout must be left unsearched or other scouts must increase their areas, thus decreasing the efficiency of the search.

Every victory of a screening ship will increase the morale of its own force and decrease that of the enemy, who, finding his information service being destroyed, will often yield the initiative and accept a defensive attitude, which is fatal to success.

TACTICS OF SCREEN WHEN ENEMY IS ENCOUNTERED BY ADVANCE SCOUTS.

When the enemy scouting line is encountered during daylight by the advance scouts, there is danger that such enemy scouts will pass the advance guard during darkness if it advances at its original speed. It will be necessary, in order to maintain the advance guard between the enemy scouting line and the main force, for it to stop or possibly to move to the rear.

One of the advance scouts should track one of the enemy scouts; the others should endeavor to obtain information of the types and disposition of the enemy scouts and the method of search that is being used.

With this information, the advance guard is so maneuvered as to be at daylight between the enemy scouts and its own main force, and at such a distance from the enemy's dark position that no scouts could have reached a position nearer the main force than the position of the advance guard.

If destroyers have been reported with the enemy scouting force or its support, this retirement of the line must be such that the advance guard will be at daylight between the main force and any position such destroyers could reach by that time.

TACTICS OF SCREEN WHEN ENEMY IS ENCOUNTERED BY FLANK GUARDS.

An enemy scout having been encountered by the flank guard, information of the type and disposition of such scouts and the method of search being used should be sought by the flank guard.

To do this the ships of the flank guard take full speed and oblique away from the main force on such a course that the component parallel to the course of the main force will be equal to the speed of the main force.

The main force should be moved toward the opposite flank such a distance that the enemy scouts can not be in or near contact at daylight, supposing them to use their maximum speed on the most favorable course during the night.

By daylight the flank guard must be reestablished. If the ships composing the original flank guard are not as fast as the ships of the enemy scouting force it may be necessary to detail a new flank guard.

TACTICS OF SCREEN WHEN ENEMY IS ENCOUNTERED BY REAR GUARD.

This position of the enemy is probably the most dangerous for the main force. A rapid movement to one flank, accompanied by a strong reenforcement of the rear guard, is probably the safest move.

TACTICS OF THE MAIN FORCE.

The tactics of the main force should be such as to avoid contact with the enemy scouting force and destroyers. The mission of the offensive screen is the destruction of the enemy's information service, and the main body should be maneuvered to keep out of contact while the screen completes its task.

CHAPTER XXII.

PROTECTIVE SCREENING.

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PROTECTIVE SCREENING.

In the previous chapter, Offensive Screening, the operation of a screen when sufficiently powerful to assume the offensive against the enemy's scouting force has been discussed.

There will be many cases, however, when the screen is not sufficiently strong to adopt such a measure; when the power of the force lies in battleships which may be too slow to operate on the offensive against the enemy scouting force; when the number of ships available are insufficient to cover an area great enough to guard against the enemy's approach, if screening is attempted at a great distance from the force screened; or when the information of the enemy's force and disposition is so meager that offensive operations might result in failure to locate the enemy scouts.

When the enemy has, or may have, a great superiority in ships suitable for scouting operations, and when the operation of the main force is essentially defensive, such as the escort of a convoy to a base lying within an area in which the enemy still has a partial control; or in the operation of proceeding with the entire fleet into an area in which the enemy has control, as in an operation to seize an advanced base; the choice of the method of screening to be used requires careful consideration.

As a premise to such an operation, we must assume that the force escorting the convoy is superior in power to the enemy force which will probably be sent against it; but this power, through lack of speed, may be useless against an enemy less powerful but faster, when the tactical handicap of the train is considered.

To each and every one who believes in the efficiency of offensive operations the first temptation is to leave the convoy and operate against the enemy.

In some cases, as in the example in offensive screening, this course offers a fair chance of immediate tactical success without jeopardizing the mission, and should be attempted, but there are grave dangers attached to it when the information concerning the enemy is not definite.

The object of the screen for the time, being purely tactical, may draw it some distance from the convoy, and may leave the convoy

without proper defense. There can be no doubt that such a situation is perilous. no

It has been pointed out under offensive screening, that terrain and roads play ~~little~~ part in restricting movements of forces at sea, and that the offensive screen in small operations can be successful only when the information of the enemy is very definite.

The other course is to use the force available protectively, to deny information of the location of the force screened at a distance from the force, such that the exact location of the force screened can not be accurately determined.

This procedure is sometimes effective, and a force decidedly inferior in fast ships may be obliged to have recourse to it. Such an operation is much more efficient against a force having no destroyers than against a force accompanied by destroyers.

To deny information to the enemy from such a distance that the smoke of the force screened will not be visible requires a great dispersion of force, for information of the approach of any enemy force must be received in time to concentrate sufficient force to oppose it.

A commander when detailing a force for protective screening must balance his desire for adequate protection against his reluctance to detach a large portion of his force, and a suitable compromise is not always easy to fix.

This operation is called "protective screening," and is defined as follows:

Operations at a short distance from the force screened, with a view to denying information of its exact position by preventing any enemy scouting force reaching a position from which the smoke of the force screened can be seen.

A protective screen is designed not only to give warning of the enemy's approach but also to deny information of the position of the force screened to any enemy force weaker than his main force, and it must be the aim of the commander of such a screen to block absolutely the passage of any such enemy force. Such enemy forces as make contact with the screen should be pursued and destroyed, if possible to do so without seriously reducing the efficiency of the screen.

The disposition of the screen may give to the enemy sufficiently definite information of the location of the force screened, unless advantage is taken of the concealment given by the screen to maneuver such force.

When the force screened is acting on the tactical defensive, the usual practice is to maneuver it so as to avoid the enemy, or to prevent or delay his contact on the day following. In deciding upon this maneuver information of contacts made by the screen should be

closely analyzed to determine the method of scouting being used by the enemy.

If destroyers are known to be with the enemy force, protective scouts should be sent out to examine the area around the force screened to a radius of at least 100 miles.

Frequently scouts will not be available in sufficient numbers for such protective scouting, and in such cases the best course of the force screened must be decided upon by a consideration of all information available.

The protective screen may or may not entirely surround the force screened. Its disposition depends largely on the information of the enemy and a consideration of his probable scouting operations.

The doctrine of a protective screen is as follows:

1. The position of the protective screen must be such that it extends across the probable course of the enemy's search, and in such a position with regard to the force screened that any enemy scouting force may be concentrated upon and stopped, before it reaches a position from which the smoke of the force screened can be seen.

2. The distance of the screen from the force screened must be such as to assure the concentration of ships of the screen to oppose the enemy scouting force.

3. The disposition of the ships of the screen should be such as to—

(a) Gain early information of the approach of enemy scouts.

(b) To assure sufficient concentration at any point to deny information to any enemy scouting force.

(c) To destroy such enemy scouting forces as make contact with the screen.

4. Except in small operations, it is impracticable to have the protective screen occupy its distant position from the force screened during daylight and draw it into a position in the defensive screen during darkness.

Several examples will be given to show different forms of the protective screen under different conditions.

EXAMPLE 1.

General situation.—War exists between Blue and Orange. The Blue fleet is based at AMAMI. GUAM is held by Blue. After an indecisive action off SIMONOSEKI, the Orange fleet retired into the INLAND SEA. The Blue fleet returned to AMAMI. A Blue force of 4 *Georgia* class, 4 *Ohio* class, 6 *California* class, 3 *Saratoga* class, and 3 *Milwaukee* class, which had proceeded to HONOLULU to act as an escort for troop ships, was directed to escort the convoy to GUAM.

In view of the absence of information concerning the enemy forces which might be met, the commander of the escort decided to form a protective screen as indicated in Sketch 45.

Special situation.—On 7 August, at 5 P. M., the *Milwaukee* sighted smoke bearing south by west; she headed for the smoke and shortly after made out an Orange merchant scout steaming east at high speed.

The *Maryland* and *Olympia* attempted to cut off this enemy merchant scout, but failed to do so until after the merchant scout had sighted the *Missouri* and *Ohio* in the southwest quadrant. The Orange merchant scout was sunk.

At 7 P. M. the escort commander received a radio from GUAM as follows: From commander in chief, AMAMI, via GUAM:

> Strong Orange raiding force, containing four battle cruisers and four battleships, left INLAND SEA, one August. Our squadron two arrives GUAM nine August; will fuel and proceed to your assistance.
>
> Maneuver to avoid engagement before reenforced.
>
> (Signed) A.

The commander of the Blue escort now realized that the enemy force he had immediately opposed to him was much stronger than the escort. He assumed that, as contact had been made so far to the eastward, no destroyers were in the vicinity. The probable area covered by the enemy scouting line in a position so far to the eastward as to cover both the northern or southern routes from HONOLULU to GUAM, would be approximately 1,000 miles long. This would require many more ships than the force reported from AMAMI. It seemed reasonable to assume that the line had been formed so far to the eastward to permit the concentration of a widely distributed force, and probably the battle cruisers and battleships were in use on the scouting line.

Having encountered an Orange merchant scout, the escort commander estimated that the main strength of the Orange force was to the southward of him. His best course lay to the northwestward, as such course would delay the concentration of the enemy fighting force and not increase his distance from GUAM.

If the enemy scouts were encountered the next day, Blue would steam to the westward until dark, then detour to the southeastward.

Blue estimated that the enemy merchant scouts would be formed on or outside his daylight circle in the northwest or northeast quadrant.

He decided to change his course at 8 P. M. to 300° and to arrange his screen as shown in Sketch 46 (a), with the idea of denying information of the position of the main force. column

The protected cruisers are formed in two ~~lines~~, each ~~line~~ 15 miles from the course of the main force. The armored cruisers are formed in two ~~lines~~, each line 5 miles from this course. The ~~lines~~ of pro-

column

SKETCH 45.

Protective screen.

tected cruisers extend 20 miles beyond the daylight circle, at 20 miles distance. The armored cruisers are spaced equally at 20 miles distance, the most distant ones being equally distant from each of the two outer protected cruisers of the nearest line.

The convoy speed has been reduced to reach a position 40 miles inside the daylight circle. The battleships are placed close to the convoy for defense during the night.

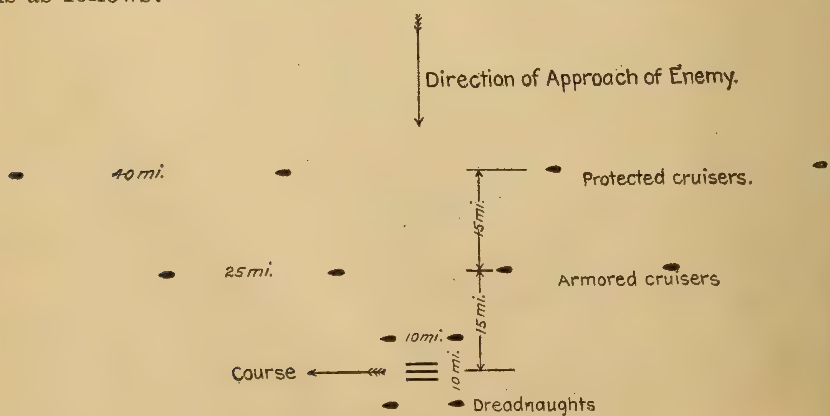
At daylight the protected and armored cruisers steam to the northward and southward at right angles to the course of the main force, those to northward of the line to the northward and those to the southward of the line to the southward, until the distance between the lines of armored cruisers is 30 miles, and between the lines of protected cruisers is 60 miles. When each type has gained its proper distance the course is made parallel to that of the main force.

When the new positions have been reached the screen will be as shown in Sketch 46(b).

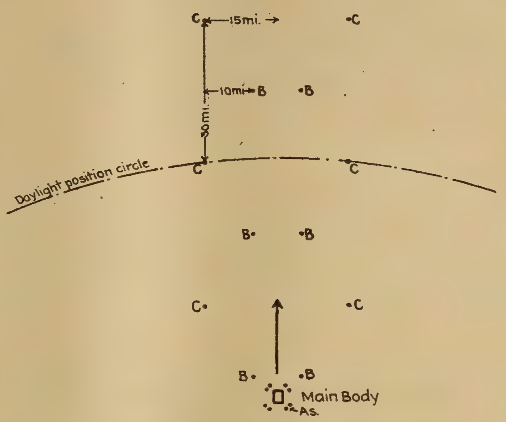
The theory of this formation is: The positions of the most advanced protected and armored cruisers are such that they would be far enough ahead of the main force to meet and repel any enemy scouts using the search from ahead. Their movement and later position on the flanks would intercept all forms of search from the flank. The rear armored cruisers cover the possibility of the use of the trailing method.

All enemy scouts encountered should be pursued and destroyed if possible.

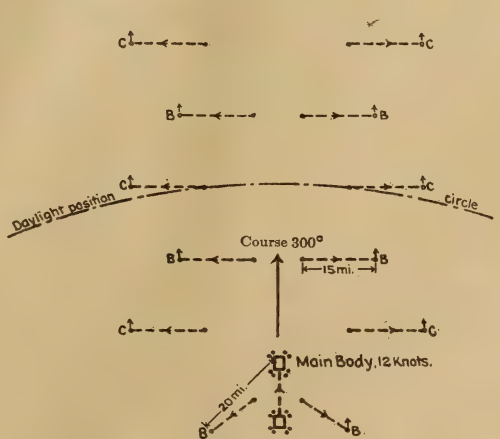
Another form of a protective screen sometimes used when information indicates the approach of the enemy scouts from one direction is as follows:



Force: Four protected cruisers, 4 armored cruisers, 4 dreadnaughts.



SKETCH 46-a.
Protective screen, daylight formation.



SKETCH 46-b.
Protective screen, expanded.

In neither of the cases previously described were destroyers present in the screen, and in no case should offensive action by the screen against the enemy force be considered to have much chance of success. The operation of the main force is essentially defensive.

A different case, but principally in degree, is presented by the movement of an entire fleet and train oversea when the enemy is superior in scouting types and in battle cruisers.

As the movement of the Blue fleet and train from HONOLULU to GUAM or some other base in the PACIFIC is an event not beyond possibility, let us examine the disposition of the screen for such a passage.

Can we screen offensively?

The area to be covered by the offensive screen would be very great. The information of the enemy would probably be indefinite. The enemy's battle cruisers are so fast and powerful that we could concentrate a sufficient force to oppose them only with the greatest difficulty.

In this chapter there is insufficient space to deal with all the considerations, but, under the supposition that a decision has been reached to screen protectively, how should the force be disposed?

In Sketch 47 is given a disposition of the screen which seems to meet the requirements of a protective screen.

In the outer circle, radius from center 60 miles, are placed destroyers in groups of four; between these groups single destroyers to cover the gaps between groups.

The ships on the outer line of the screen are called "pickets." The destroyers in the outer line of the screen have a twofold mission:

(a) To detect and report the approach of enemy scouts.

(b) To attack the enemy scouting force after dark.

To detect the enemy's approach single boats might be as efficient as groups, but for attacking, groups are required.

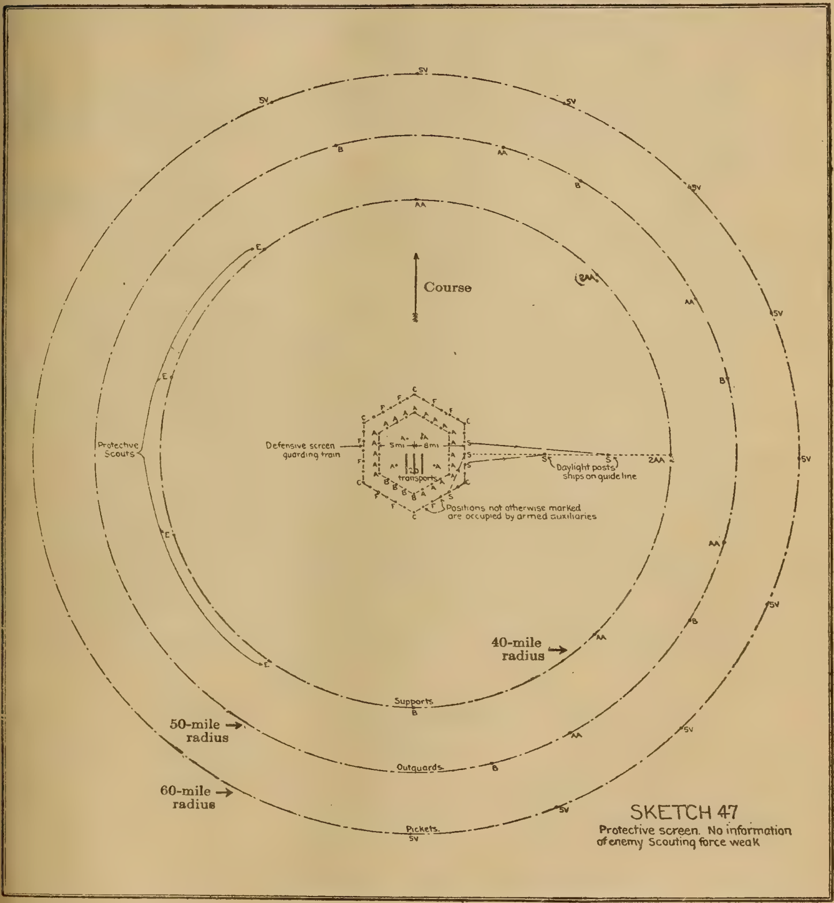
TACTICS OF THE PICKET LINE.

The pickets should investigate any smoke sighted, and upon making out any enemy scout should report broadcast its location, type, and course, and should track the enemy scout. Destroyers, in good weather, should be very efficient in this operation, as their speed permits freedom of movement against all types except enemy destroyers.

Upon contact with an enemy scout being reported, the nearest group of destroyers should move to surround such scout, forming a semicircle on the side away from the screen. They should then track such scout until dark and attack it after dark.

Any enemy force seeking to penetrate the screen is the legitimate object of attack by destroyers after dark. If the enemy ship sighted is a battle cruiser or battleship, the two groups of destroyers nearest it should act together to sink it after dark.

If pickets are attacked by superior force, they use their speed to avoid action or, if necessary, retire upon the outguards.



SKETCH 47
Protective screen. No information of enemy Scouting force weak

TACTICS OF OUTGUARDS.

The second line of the screen, radius 50 miles, is composed of armored cruisers and dreadnaughts. This line is called the outguard line and the ships outguards.

The outguards assist the pickets if they are threatened in daylight by superior forces, and in case an enemy scout of inferior power passes the picket line they coordinate their movements to stop such scout and cut it off from retreat.

TACTICS OF SUPPORT.

The third line of the screen, radius 40 miles, is composed of fast battleships, usually dreadnaughts; this line is called the support line and the ships supports.

The supports, acting upon information from pickets and outguards, so maneuver as to oppose to any enemy force a force superior in power, and cause the enemy to retire or make such change of course as to prevent such enemy sighting the smoke of the main force.

An enemy force strong enough to necessitate a concentration of the support should be made the object of a concerted destroyer attack after dark.

If the enemy force is accompanied by destroyers, the outguard and even part of the main body defensive screen may have to be directed to reinforce the supports to protect them against the enemy destroyers.

The destroyers of the screen should not be used defensively at night. If during daylight a superior force can operate against the enemy destroyers, they should do so, but when darkness comes the destroyers should be used offensively against such enemy major ships as have approached the screen.

When the enemy is persistent in his attempts to gain information, it should be considered probable that enemy destroyers are in position to attack. In this case destroyers should be advanced from the picket line to scout protectively in all directions. The information they obtain concerning the position of the enemy destroyers may afford the main force an opportunity to maneuver to avoid the attack.

SUMMING UP.

The protective screen consists of two or three lines of ships so disposed as to deny information to the enemy.

Ships in the outer line are called pickets.

Ships of the second line are called outguards.

Ships of the third line are called supports.

If there is an additional force for general support of the screen, it is called a reserve. It would be centrally located nearer to the van of the screen than to its rear.

It is seldom that a protective screen will be used by a force unaccompanied by a train or convoy.

The area to be covered by the protective screen is controlled by the movement of the force screened, by the assumed direction of approach of the enemy, and by the strength of the enemy's scouting force.

Until the enemy is encountered, the protective screen maintains its position during darkness; and, during daylight, when an area is reached in which an encounter with the enemy is anticipated, should maintain steam for maximum speed.

At or near the center of the protective screen is the main force. The main force should be disposed for defense against attack by destroyers. The disposition of the force for this purpose is defensive screening and will be considered in the next chapter.

There is a tendency to consider protective screening as an end rather than as a means to an end. It is passive in its nature. It is designed to deny information to the enemy and to form a concealment for the maneuver of the main force. It should be no stronger than the requirements of the situation necessitate. It is not a battle formation.

Passive operations, inactivity, and defensive tactics have never yet won a war. Action is the keynote to success. A passive or defensive attitude is no more than a preliminary which is sometimes forced upon us through lack of information or lack of proper material.

In fleet operations, this passive attitude should be abandoned with the first contact. The destroyers and such other types as have sufficient speed should immediately assume the tactical offensive.

Protective scouting forces are sent out to locate enemy forces. If the enemy destroyers can not be attacked in daylight, the main force must be maneuvered to avoid such area as they can reach during dark. If the enemy main body is located, it should be attacked by destroyers.

Protective screening has its place in war, but it is essentially defensive and when the enemy's fighting forces approach should, if there is a chance of victory, be abandoned for the offensive.

CHAPTER XXIII.

DEFENSIVE SCREENING.

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DEFENSIVE SCREENING.

The third form of screening operations is designed to defend the force screened against attack, usually from torpedo craft, and is called defensive screening.

The defensive screen is a close screen around the main body, train, or whatever force is to be defended, for the purpose of disclosing the approach of enemy vessels, especially torpedo craft, and of destroying such enemy vessels sighted.

The usual form of the screen is circular or polyhedral, surrounding the force to be defended.

The outer line, called defensive screen pickets, should be composed of vessels of small value, having good searchlights; gun power is valuable, but not of primary importance.

Necessity may force the use of destroyers in this capacity, but such use of destroyers is not advisable for the following reasons:

(a) The destroyer is primarily an offensive type. It has a potential power as great as that of a battleship if it can arrive at the proper position to use its weapon. To use the potential power of a battleship against a destroyer is bad tactics if it can be avoided, and it can be by making the proper preparation for screening ships.

(b) The rapid motion of destroyers in a sea and the low power of their searchlights will seriously reduce their value as illuminating ships.

(c) The enemy destroyers will usually attack in groups and the one or two destroyers they encounter in the picket line will probably be sunk.

Ships such as the Merchants & Miners' Line could be fitted with large searchlights and a battery of numerous 3-inch guns and become most effective ships for duty in the picket line of a defensive screen.

The second screen line, called defensive-screen outguards, should be composed of vessels of good antitorpedo-craft battery. These should also have good searchlight power.

The small cruisers of the *Tacoma* class, if fitted with powerful searchlights, are suitable for this duty.

The third line, called defensive-screen supports, should be ships of good battery power and have good searchlights.

The armored cruisers are excellent ships for such positions, but in all probability they would be in use in the protective or offensive screen. It will be necessary, therefore, to use battleships. As the older battleships have an antitorpedo-craft battery of good power, they should be used.

The radius of the picket, outguard, and support line is dependent largely on the size and disposition of the force defended.

In Sketch 48 is shown a defensive screen disposed in a rectangle defending a convoy of 40 transports.

The transports are in line of squadrons. Interval, 4,000 yards; distance, 1,000 yards.

The great size of the force to be defended has made it necessary to use all except two of the battleships for supports.

The dreadnoughts and destroyers are absent from this formation, as they are acting as pickets and supports for the protective screen.

The defensive-screen supports are 4,000 yards ahead and on each flank, and 2,000 yards in rear of the transport columns, at distance of 4,000 yards. The two additional battleships are disposed as a reserve ahead of the transports.

The defensive-screen outguards are placed 3,000 yards outside of the supports. These ships, if enough are available, should be placed at 4,000 yards distance, but if not a sufficient number are available they should be so placed that they command with guns the passages between the pickets.

The defensive-screen pickets are placed 3,000 yards outside of the outguards and at a distance which should not exceed 4,000 yards.

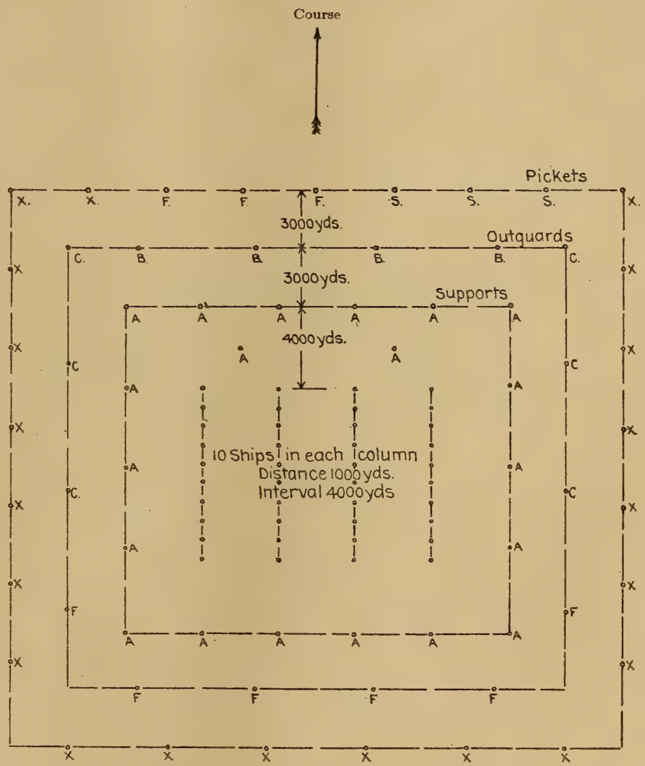
In the sketch the pickets are armed auxiliaries of the train. In an oversea campaign these auxiliaries would be very valuable ships and, if possible, provision should be made for pickets whose loss would entail less serious consequences to the fleet.

The destroyers of the fleet are in the picket line of the protective screen.

The force defended should be in such formation that the ships of greatest value are inside.

The formation of train, transports, and battleships inside of the defensive screen should be an open one, to permit of simultaneous changes of course or speed. The distance should not be less than 1,000 yards and the interval between columns not less than 4,000 yards. The more open the formation the less the danger that a torpedo missing one ship may hit another.

Destroyers should be used in a defensive screen only when no other force is available. If there is a protective screen they should be detailed to it; if there is no protective screen they should be used offensively against the enemy main force. In any case, they should be so disposed as to make certain that they will not under any circum-



SKETCH 48.
Defensive screen.
Designed to defend train against destroyer attack.

stances be mistaken for enemy destroyers. Their gun power is small, and the possibility of damage and confusion due to mistaken identity is great, and might be disastrous.

If present as pickets, they should be placed at a greater distance from the outguards and instructed not to follow enemy destroyers toward the center of the screen.

TACTICS OF SCREEN.

PICKETS.

Searchlights will not be used until certain that enemy destroyers have been sighted. Pickets will then illuminate the enemy destroyers and use such gun power as they have to destroy the enemy.

It has been demonstrated that the flashes of the guns of anti-torpedo craft battery can be seen as far as a searchlight ray can be seen. There is, therefore, no excuse for not using searchlights after it has been decided to open fire.

OUTGUARDS.

The outguards fire at the enemy destroyers illuminated by the pickets. When such destroyers have passed beyond the rays of the searchlights from the pickets, or in case the number of searchlights in the picket line is insufficient to illuminate all of the attacking boats, the outguards turn on their searchlights.

SUPPORTS.

The supports fire at the attacking boats illuminated by the pickets and outguards, and when the attack has reached the support line turn on their searchlights. Fire is then opened by the reserve or main body, if any such is inside of the supports.

In case the enemy destroyers are supported by battle cruisers or other ships of good gun power, such ships may attempt to prepare the way for the torpedo attack by attacking ships of the picket and outguard line.

Such an attack is disastrous to the screen, and major ships must be detached and directed to engage such enemy vessels.

The use of a defensive screen for any purpose but defense against torpedo or other attack which can not be foreseen, is fatal to success, for all initiative is thus given to the enemy.

It must always be remembered that the value of information concerning the enemy indicates how very necessary it is to deny information to him. Defensive screening does not deny information, as the screen is too close to the force defended to prevent the enemy gaining information of its presence.

CHAPTER XXIV.

PROTECTIVE SCOUTING.

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PROTECTIVE SCOUTING.

Three forms of operations comprised in the service of security, namely, offensive screening, protective screening, and defensive screening, have been discussed.

Forces preforming screen duty must have strength to resist that which they are designed to hold outside of the screen. There is, however, another form of this service in which the forces operate only with a view to obtaining information of the enemy, upon which information the main force is to base defensive operations with a view to evading the enemy or making proper dispositions for battle. This is called protective scouting.

Protective scouting is scouting operations confined—

(a) To insuring the absence of the enemy from areas from which the main force may be threatened.

(b) To obtaining just sufficient warning of the enemy's proximity to facilitate evasion or to assure adequate time for taking up battle formation.

Protective scouting is a passive operation. It differs from aggressive scouting in that its mission is one of security; to give warning of the enemy's presence being its principal object.

As the area from which a force may be threatened moves with the movement of such force, the area to be searched by a force engaged in protective scouting is based upon the course and speed of its own main force. In aggressive scouting operations the area to be searched is based upon information of the enemy main force.

No force, however strong, or how apparently free from observation, should fail to detail a sufficient force for protective scouting, unless covered by a protective screen, for the knowledge as to whether or not the enemy scouts have made contact with the main force may be of vital importance in the succeeding operations.

The distinction between a protective scouting force and a screen lies in the mission of the force.

The primary mission of a protective screen is to deny information to the enemy. Its secondary mission, to inform its own main force of the presence of the enemy.

The primary mission of a protective scouting force is to inform its own main force of the presence of the enemy. Its secondary mission, only attempted when the enemy force in contact is much inferior, is to prevent the intrusion of enemy scouts.

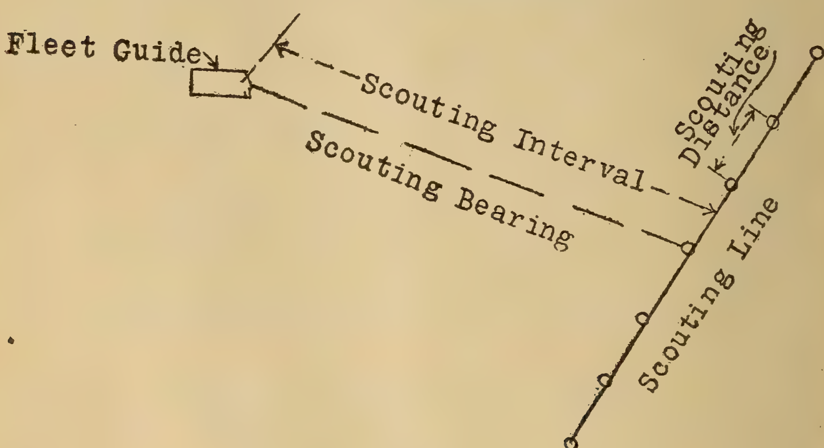
The disposition of the protective scouting force may be a straight line across the probable direction of the enemy's approach or on a portion or the whole of an arc of a circle around the main force.

When the scouts are disposed in a straight line, as in Diagram 9, the following terms are used to define the disposition:

Distance of center of scouting line from fleet guide = scouting interval.

Bearing of center of scouting line from fleet guide = scouting bearing.

DIAGRAM 8.



Line of bearing of scouts = scouting line.

Distance between adjacent scouts = scouting distance.

When the scouts are disposed on the arc of a circle around the main force, as in Diagram ~~10~~ 9, the following terms are used to define the disposition:

Distance of scouting line from fleet guide = scouting radius.

Bearing of center of line from fleet guide = scouting bearing.

Distance between adjacent scouts = scouting distance.

In detailing a force for protective scouting the commander should keep in view five conditions:

(a) The length of the scouting line, or arc, to be covered.

(b) The scouting interval or scouting radius.

(c) The proportion of the force that can be spared for detached duty.

(d) The desirability of preventing intrusion by enemy scouts.

(e) The speed and strength of the ships detailed for protective scouting.

The length of the scouting line, or arc, to be covered depends upon the information of the enemy's scouting forces and main body. If the information is definite, it may be possible to limit the area searched by the protective scouts to an area from which the enemy will probably approach. It is usually advisable, if the force available is sufficient, to form the protective scouts on a circle extending completely around the main force.

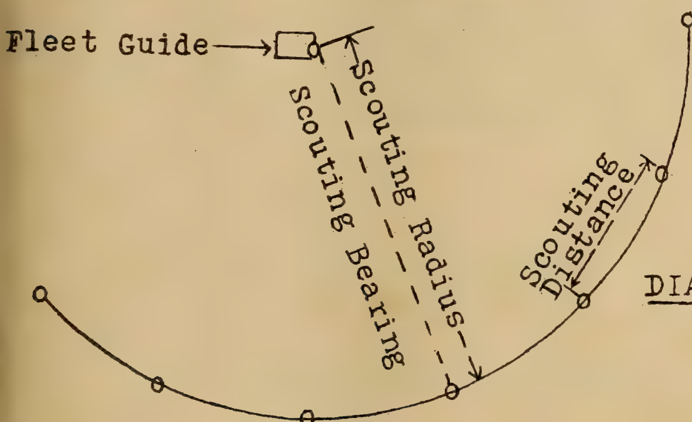


DIAGRAM 9.

The distance of the scouting line from the main force, or the radius of the arc if formed on an arc, is dependent upon the angle which it is desired that the scouts shall cover (the greater the distance from the fleet guide the smaller the angle which can be covered by a given number of scouts), and also on the state of preparation of the main force for battle. If preparations are complete (steam in all boilers, etc.), not much warning will be required; if, however, the main force is steaming at low speed to save fuel, the protective force should be at such an interval or radius as to assure the main force ample time to prepare for battle.

The proportion of the force that can be spared for protective scouting depends largely upon the comparative force and type of the enemy's ships, the probability of attack, and the relative speeds of the forces. No set proportion could in any way fix the proper force.

A commander, when detailing a force for protective scouting, must balance his desire to guard against surprise or unknown observation by the enemy, against his reluctance to detach a large proportion of his force for protective scouting. A suitable compromise is not

always easy to fix. If the protective scouting force is distant, concentration for battle is delayed; if close, security from observation is not assured.

In general, it is advantageous to form the protective scouting force so that an enemy's scout can not see the smoke of the main force without itself being seen by one of the protective scouts.

Fast ships of small fighting value are probably the best type for this service, though, when such vessels are engaged in aggressive scouting, destroyers, gunboats, or even battleships may be forced to do this duty.

Destroyers have frequently been used to surround a fleet at night for the purpose of discovering the approach of the enemy's destroyers.

This disposition has been called a screen, but as the essential element of a screen, power to resist, is absent, it seems preferable to consider such an operation as protective scouting.

CHAPTER XXV.

ORDERS AND REPORTS.

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ORDERS.

GENERAL REMARKS.

The consideration of the acquirement and transmission of information leads inevitably to the recognition of the importance of a general knowledge of the art of war, not only in those officers to whom the search for information is intrusted but also in those through whom information is normally forwarded. For the final value of reconnoissance depends very much on the ability of subordinate commanders to discern the facts or deductions which will be of use to their superiors. Such discernment is partially, no doubt, dependent on natural judgment and sense of proportion, but it is chiefly acquired by sound education in the art of war.[1]

RESPONSIBILITY FOR MAINTAINING COMMUNICATION.

The constant maintenance of communication between various parts of a force is of urgent importance; it is on this to a great extent that the possibility of cooperation depends.

All subordinate commanders are responsible for keeping their respective superiors, as well as neighboring commanders, regularly informed of the progress of events and of important changes in the situation as they occur.

The elaborate means of communication provided under modern conditions should not, however, be used in such a manner as to cripple the initiative of subordinates by unnecessary interference.[1]

SCOUTING ORDERS.

The scouting forces will generally be under the direct command of the commander in chief, or of a scout commander, to whom the commander in chief delegates the responsibility for gaining the required information. The commander in chief alone can give to the scouting forces such instructions as will coordinate their operations with the operations of the main force to the accomplishment of the end in view.

In scouting operations coordination of effort is imperative, and the commander in chief or scouting-force commander should give such instructions as may be necessary to insure cooperation. The

[1] Art of Reconnaissance: Henderson.

amount of detail contained in the instructions to the scouting force will vary with the conditions and with the difficulty that may be encountered in coordinating their operations.

Instructions to the scouting force should contain:

1. All that is known of the enemy.
2. Statement of the general situation.
3. Indication of proposed direction of effort and objective.

In order that these instructions may be reduced to a minimum, it is necessary to use a common nomenclature for types of operations. We must understand and have names for common methods of procedure. Uniformity in the expression of ideas will permit the simplification and reduction of our radio messages and radio code.

In order to facilitate cooperation, the whole of the directions to each portion of a force taking part in a combined operation will usually be embodied in one campaign order. When for any reason separate orders are issued instead of a combined order, each separate order will include such information regarding other forces as the recipient might find it useful to know.

The statement of the intentions of the commander must be framed with great care. Only so much should be stated as it is really necessary for those to whom the order is issued to know for the purpose in view. It is seldom necessary or advisable to look far ahead *in stating intentions.* In the case of the orders of subordinate commanders, the intentions stated should be those of the authority actually issuing the order, arising out of those communicated to him by higher authority. Alternative and conditional statements, depending upon developments, are very apt to cause doubt and uncertainty and should be avoided.

During the course of operations it will often be necessary to supplement the orders already issued by further campaign orders, which may take the form either of complete fresh orders or separate orders issued to one or more units of the command. In the latter case, should the original orders be modified to any considerable extent, all other units of the command affected by the new order should be informed of its purport.

Notwithstanding the greatest care and skill in framing orders, unexpected local circumstances may render the precise execution of the orders given to a subordinate unsuitable or impracticable. Under such circumstances the following principles should guide an officer in deciding on his course of action:

1. A formal order should never be departed from either in letter or spirit—

(a) So long as the officer who issued it is present;

(b) If the officer who issued the order is not present, provided there is time to report to him and await a reply without losing an opportunity or endangering the command.

2. A departure from either the spirit or the letter of an order is justified if the subordinate who assumes the responsibility bases his decision on some fact which could not be known to the officer who issued the order, and if he is conscientiously satisfied that he is acting as his superior, if present, would order him to act.

3. If a subordinate, in the absence of a superior, neglects to depart from the letter of his orders, when such departure is clearly demanded by circumstances, and failure ensues, he will be held responsible for such failure.

4. Should a subordinate find it necessary to depart from an order, he should at once inform the issuer of it, and the commanders of any neighboring units likely to the affected.[1]

REPORTS.

As the accuracy of the conclusion in logic rests upon the truth of the premises, so the worth of a decision in war rests upon the accuracy with which the situation is presented by the information at hand.

Timely information regarding the disposition and intentions of the enemy, and of the topographical and hydrographical features of the theater of operations, is an essential factor of success in war. A commander without information is like a man blindfolded; he knows neither where to strike nor from what quarter to expect attack; he is unable to make a plan for himself or to guard against the plan of his enemy.

The acquisition of accurate information is one of the most difficult tasks of a commander. The numbers, the dispositions, the movements of the enemy are veiled in an obscurity which has been aptly termed the *fog of war*—an obscurity which the opposing commander will endeavor in every way to deepen.[2]

The pages of history are filled with instances where victory was wrested from a superior force by virtue of the initiative with which accurate timely information endows its possessor.

Yet so indirect is the influence of information, so much is its value overshadowed by the evident effect of strategical and tactical combinations, that we often forget that the plans by which such combinations were effected were based upon accurate information.[3]

The worth of information as received at its destination is dependent upon:

1. Accuracy of observation.
2. Relevancy.
3. Accuracy of statement.
4. Accuracy of transmission.

Accuracy of observation.—This includes accuracy of observation of objects and of events. The objects will usually be ships of the enemy, and accuracy of observation can be best attained by a study of the silhouettes and characteristics of the enemy ships. The events will usually be strategical and tactical operations, and accuracy of observation can be best attained by participation in similar operations at sea and on the maneuver board. An indispensable

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[1] British Army Field Service Regulations.
[2] Furse: Information in War.
[3] Henderson: Art of Reconnaissance.

quality of a message is a scrupulous accuracy as to facts. Surmises should never be given as facts, and a person sending a message should carefully separate facts from surmises.

Relevancy.—The relevance of a report, which in reconnoissance is almost the same as its value, is a matter deserving the greatest attention. The value of the information is dependent upon the situation and perhaps on the magnitude of the operations; information which may be of value to the commander of a scouting force may or may not be of value to the commander in chief. Every officer should therefore consider how much of the information is of value to himself alone and how much is worth transmitting to his superior. At sea the radio will be the principal means of communication, and the interference caused by sending irrelevant information may prevent the receipt of vital information. All officers should keep in mind the general situation in order that they may properly estimate the relevancy of any information they obtain.

Accuracy of statement.—Clearness must always be the essential: if brevity can be combined with it, so much the better. The sequence of ideas should follow the form prescribed for order writing as closely as possible. Definite statements are desirable, but care must be taken to make no definite statements unless there is definite knowledge behind them. Definite statements on insufficient authority are misleading and dangerous. If the strength of the enemy, for instance, has been roughly estimated, it should be so stated. if it is reported on hearsay, the authority for the statement and an opinion of the credibility of the informant should be given.

It is not enough that a statement should be accurate; it should convey an accurate impression. Every precaution should be taken to assist the recipient of the message in grasping the meaning with a minimum of trouble and delay. The purpose of a message is to enlighten the recipient, and a technical accuracy is no excuse for making a statement which is open to misconstruction.

Accuracy of transmission.—This is dependent upon the efficiency of the method and upon the efficiency of the code.

REPORTS TO BE MADE.

The following list of reports to be made is not necessarily complete and should be used only as a guide.

Single ships should report:

1. When smoke is sighted, nature of smoke and action to be taken—to adjacent ships and detachment commander.

2. When enemy ship or ships are sighted, with statement of enemy force, and action taken—to adjacent ships and detachment commander.

3. When there is a marked change in the conditions last reported, including weather conditions—to adjacent ships and detachment commander.

4. When and where contact with the enemy is lost—to adjacent ships and detachment commander.

5. Daylight and dark position reports with anticipated procedure—to adjacent ships and detachment commander.

6. Accidents, unusual fuel consumption or other defects that interfere with the proper performance of duty assigned—to adjacent ships and detachment commander.

7. Acknowledgment of orders—to group commander.

8. Sighting of enemy main body, train, or destroyers—broadcast.

9. Hourly reports of position of enemy and his approximate speed and course, when tracking—broadcast.

Group commanders should report:

1. Any information of enemy or conditions that would be of value to the commander in chief—to commander in chief or scouting-force commander.

2. At night, anticipated operations of group for following day—same.

3. Acknowledgment of orders—same.

CAMPAIGN TO ILLUSTRATE RETIRING SEARCH METHODS AND SCOUTING ORDERS.

The assumptions upon which this campaign is based are as follows:

War exists between Orange and Green (Russia).

The Orange main fleet, after having destroyed Green's Pacific Fleet, is based at TSUSHIMA.

The Green Fleet (2d Pacific Fleet) has proceeded from the Baltic and at last reports was off AMOY.

Orange has maintained a squadron of 6 ships to observe the area of the EASTERN SEA between the CHINA coast and the LOO CHOO group of Islands.

Radio stations and lookouts were established in the islands south of FORMOSA and in the LOO CHOO group. Fishing vessels patrolling the BASHEE and BALLINTANG CHANNELS at night.

At daylight 31 May a squadron of 6 merchant scouts, under command of Rear Admiral Oku, relieved a cruiser squadron as the observation force. The cruiser squadron returned to TSUSHIMA to coal.

A division of 3 second-class cruisers had been sent to the BONIN ISLANDS as a Flank Guard.

SITUATION, 1 JUNE, 5 A. M.

(Sketch 49.)

On 1 June, 5 A. M., the Orange disposition was as follows:

The Orange main body, destroyers and a cruiser squadron, six 18-knot ships, are at TSUSHIMA.

The main body and destroyers are ready for sea. The cruisers are coaling and will not be ready for sea until 2 June, 4 A. M.

The merchant scout squadron, maximum sustained speed 20 knots, is, at daylight, on scouting line 293°, distance 50 miles. The search from ahead is being used. The line is being maintained. Course, 203; speed, 8.6 knots during daylight.

Division Seventeen is maintaining a radio chain between scouting force and main body.

On 1 June, 5 A. M., the Green fleet and train is sighted by the lookouts in BALLINTANG CHANNEL, heading to the eastward. This information is relayed by radio to the scout commander and is received by him at 9 A. M. He sends this radiogram to the Commander in Chief:

From Commander Squadron Five:

Enemy main body and train, BALLINTANG CHANNEL, one June, five A. M., heading eastward.

Squadron Five will search eastward from line bearing seven from enemy position. Sector Method.

He sends the following to his own squadron:

From Commander Squadron Five:

Enemy main body and train, BALLINTANG CHANNEL, one June, five A. M., heading eastward.

Squadron Five will search eastward from line bearing seven from enemy position. Sector Method.

In the first message the scout commander has given to the commander in chief all the available information concerning the enemy. He has also stated his contemplated action. This statement makes it easy for the commander in chief to assign areas to the other scouting forces which will not conflict with the operations of the Squadron Five. Had this information not been given, the commander in chief would not have known the intention of the commander of Squadron Five, and he would have had to inquire its disposition and position before he could have written a satisfactory order.

In reporting contacts with the enemy, or information concerning the enemy, always state the action to be taken by the force under your command.

In the second message, which was sent to his own squadron, he gave them the available information concerning the enemy and

directed a concentration toward the positions he expects the ships of the squadron to occupy at daylight the next morning. He did not give his plan to his subordinates, as there was ample time to have his plan approved by the commander in chief. His plan might not be approved by the commander in chief. The commander of Squadron Five has given all the instructions required for the present and has avoided the possibility of having to countermand an order.

Do not give hasty orders. Countermanded orders create confusion and lack of confidence in the commander.

The commander in chief, upon receipt of the commander of Squadron Five's radio, issues a combined order as follows:

FLEET ORDER ISSUED BY COMMANDER IN CHIEF.

FROM TSUSHIMA, 1 JUNE, 11 A. M.

From Commander in Chief:

Enemy main body and train BALLINTANG CHANNEL, one June, five A. M., heading eastward.

Seek decisive engagement.

Southern Scouts, Squadron Five, search eastward from line bearing seven from enemy's reported position.

Central Scouts, Squadron Three, search from ahead to westward of BONIN ISLANDS.

Flank Guard, search northward from line bearing one ten from enemy's reported position.

Main Body will proceed two June, eight A. M., toward position Lat. twenty-nine, Long. one thirty.

Radio Chain maintain communication between scouting force and main body.

Train remain TSUSHIMA.

One hundred thirtieth time.

Cipher X. Wave length nine hundred. Campaign Order Five TSUSHIMA, one June, eleven A. M.

In this message the two task groups, Southern and Central Scouts, were designated. It was necessary to state the composition of these groups in the order. The Main Body, Flank Guard, and Radio Chain had been previously designated, and therefore no statement of the composition of such groups was required. Detailed dispositions of scouting forces and designation of methods to be used indicate that the commander in chief considers himself the scouting force commander.

The time, cipher, and wave lengths to be used would not appear in the order unless they had not been previously designated or a change was made by this order.

It will be noticed as the search progresses that by this arrangement of the areas and methods of search of these scouting forces, such forces are, during the search, continually drawing closer together, thus concentrating as much as possible before contact is made with the enemy.

DETACHED SCOUTING FORCES SHOULD BE SO OPERATED AS TO EFFECT CONCENTRATION AS THE SEARCH PROGRESSES.

From Commander Southern Scouts:

No further news of enemy. Our main body will proceed two June, eight A. M., toward Latitude twenty-nine, Longitude one thirty.

Central Scouts, Squadron Three, will search from ahead to westward of BONIN ISLANDS.

Flank Guard will search northward from line bearing one ten from enemy's reported position.

Radio Chain maintaining communication with Main Body.

Southern Scouts, Squadron Five, will search for enemy's main body.

Be in position on line bearing seven from position Lat. nineteen fifty, Long. one twenty-one fifty, and start search to ~~westward~~ eastward two June, five A. M. Regular order, E–1 to northward. Sector Method. Sector thirty-five. Assume enemy speeds twelve to seven. One thirtieth time. Cipher "X." Wave length nine hundred. Campaign Order One. Central Scouts.

In this order the information of the enemy is not repeated, as all of the available information of the enemy had been furnished this squadron by a previous radio order.

In paragraphs 1 and 2 the composition of the Central and Southern Scouts is given. These task groups had not been previously organized, so it is necessary to state their composition. The Main Body, Flank Guard, and Radio Chain are the same as in the original disposition, so the composition of these forces need not be repeated.

The number of changes in course during daylight, to be made while running the retiring search, is not given as it should be fixed beforehand.

The time, cipher, and wave length would be omitted if previously assigned, unless they were to be changed by the order.

In paragraph 5 appears the words "Central scouts." This indicates to the radio chain that the commander of the Southern Scouts desires a copy of this order relayed to the commander of the Central Scouts.

Upon receipt of commander of Squadron Five's campaign order each ship of Squadron Five should change course and speed to arrive in position at the specified time. Each ship should report to the squadron commander the position he expects to occupy 2 June, 5 A. M.

On 2 June, 5 A. M., each ship of this squadron should report her position to the squadron commander.

The commander of Squadron Three does not issue a campaign order at this time, as his squadron can not get underway before 2 June, 4 A. M. He signals, "Be prepared to get underway 2 June, 4 A. M. Speed, 18 knots."

Before getting underway he should call his commanding officers on board and inform them of his general plan, but he should issue no campaign order for search operations at this time.

The commander of the Flank Guard at COFFIN BAY receives the commander in chief's combined order at 8 p. m., and immediately signals, "Prepare to get underway at ten P. M. Maximum speed." He then writes the following campaign order and, having called his commanding officers on board, delivers it in person:

Flank Guard,
H. M. S. F–1, Flagship.

CAMPAIGN ORDER
No. —.

Bonin Islands,
1 June 1914—9.00 P. M.

1. Enemy main body and train BALLINTANG CHANNEL, one June, five A. M. Our main body will proceed two June, eight A. M., toward lat. twenty-nine, long. one thirty. Central Scouts, Squadron Three, will search from ahead to wastward of BONIN ISLANDS. Southern Scouts, Squadron Five, will search eastward from line bearing seven from enemy's five A. M. position. Division Seventeen will maintain radio communication between scouting force and main body.

2. This force will search for enemy main body.

3. (a) F–1, twelve.
   (b) F–2, ten.
   (c) F–3, eight.

(x) Assume enemy speed in knots as above. Search northward from line bearing one ten degrees from lat. nineteen fifty, long. one twenty-one fifty. Independent search. Proceed maximum speed. One thirtieth time.

4. ——————.

5. Cipher "X." Wave length nine hundred.

/s/ SUKI,
Rear Admiral, Commanding Flank Guard.

Copies to—
Commander-in-Chief.
Commander, Southern Scouts.
Commander, Central Scouts.
By radio.
Commanding Officers, Division Nine.
Delivered on board.

/s/ ———,
Lieut., Flag Secretary.

OPERATIONS ON 2 JUNE.

(Sketch 49.)

During 2 June the Southern Scouts are searching the area prescribed for the day. The Flank Guard is steaming to the southwestward toward the meeting points on the prescribed line for commencing the search. The Radio Chain is moving eastward to maintain communication. The Central Scouts finish coaling at 4 A. M. and sail from TSUSHIMA, in accordance with the combined order previously issued.

MAIN BODY ORDER.

At 8 A. M. 2 June the main body sails from TSUSHIMA in accordance with the following campaign order, which was issued on board the flagship on the evening of 1 June:

Main Body,
H. M. S. Makasa, Flagship.

CAMPAIGN ORDER
No. —.

Off Tsushima,
1 June, 1914—8.00 P. M.

1. Enemy main body and train BALLINTANG CHANNEL, one June, five A. M. Central Scouts, Squadron Three, will search from ahead to westward of BONIN ISLANDS. Southern Scouts, Squadron Five, will search eastward from line bearing seven from enemy's reported position. Flank Guard will search to northward from line bearing one ten from same position. Division Seventeen will maintain radio communication.

2. This force will seek decisive engagement.

3. (a) Squadron One.
(b) Squadron Two.
(c) Destroyer Flotilla.

(x) Be prepared to get under way two June, eight A. M., speed twelve. One thirtieth time.

4. ———————.

5. Cipher "X." Wave length, nine hundred.

/s/ TIGI,
Admiral, Commander in Chief.

Copies to—
Division Commanders and
Commanding Officers,
Squadrons One, Two, and
Destroyer Flotilla.
By guard boat.

/s/ ———,
Lieut. Comdr., Flag Secretary.

The commander of the Central Scouts, finding he has ample time to reach his station to westward of the BONIN ISLANDS before the enemy could possibly arrive, decides to aid the Southern Scouts, by running a patrol search during 3 June, assuming the enemy speed as 12 knots. He sends out the following campaign order by radio at 3 P. M.:

From Commander of Central Scouts:

No further news of enemy. Our main body sailed from TSUSHIMA, two June, eight A. M.

Search for enemy main body.

Patrol method to eastward. Regular order. Distance fifty. Scouting speed eighteen. C–1 at point of origin, lat. twenty-seven twenty, long. one twenty-nine, thirty, three June, five A. M. Assumed enemy maximum speed, twelve. Obtain distance by that time.

One thirtieth time. Cipher "X." Wave length nine hundred. Campaign Order Two. Southern Scouts.

In this order the information of the enemy is not repeated, for the commander of the Central Scouts had called all his commanding officers on board before sailing and gave them all of the information contained in the Commander in Chief's Campaign Order. The information concerning the Orange main body is confirmatory of the information given the night before.

The time, cipher, and wave length should be omitted unless not previously designated or a change was made by the order.

The words "Southern Scouts" at the end indicate that the radio chain is to relay the order to the Commander of the Southern Scouts.

The commander of the Southern Scouts receives the campaign order of the Central Scouts at 5 P. M., and upon plotting the track of the Central Scouts for 3 June, finds that on 3 June it is not necessary for his force to cover assumed enemy speeds higher than 11 knots. He decides to use the sector method on 3 June, covering enemy speeds 11 to 8½ knots. At 6 P. M. he issues campaign order 2 by radio:

From Commander Southern Scouts:

No further news of enemy. Our main body sailed from TSUSHIMA, two June, eight A. M. Central Scouts will, on three June, run patrol search to eastward from lat. twenty-seven twenty, long. one twenty-nine, thirty. Assumed enemy speed twelve.

Continue search by present method three June, five A. M. Sector twenty-three. Assume enemy speeds eleven to eight and one-half.

Campaign Order Two. Central Scouts.

The information of Orange forces confirms the sailing of the Main Body and informs the Southern Scouts of the contemplated action of the Central Scouts for 3 June.

The Flank Guard continues its operations, but, as it is out of radio communication, makes no report.

At 6.30 P. M. the Commander of the Southern Scouts signals by radio:

From Commander Southern Scouts:

Retire at seven P. M. Course forty-two.

OPERATIONS, 3 JUNE.

(Sketch 50.)

The Orange Main Body arrives at its position in readiness.

The search operations continue as planned.

On 3 June at 5 P. M. the Commander of the Central Scouts sends a radio to his force:

From Commander Central Scouts:

Retire at seven P. M. Course sixty. Speed twelve.

At 7 P. M. he issues the following campaign order:

From Commander ~~Southern~~ Scouts: Central

No further news of enemy. Our main body in designated position.

Continue search by present method four June, five A. M.

Campaign order two. Southern scouts.

The Commander of the Southern Scouts at 6 P. M. sends the following radio to his force:

From Commander Southern Scouts:

Retire seven P. M. Course sixty-five.

After receiving the campaign order of the Central Scouts he sends the following campaign order:

From Commander Southern Scouts:

No further news of enemy. Our main body in designated position.

Continue search by present method four June, five A. M. Sector sixteen.

Campaign order three. Central Scouts.

OPERATIONS, 4 JUNE.

(Sketch 51.)

About 5 P. M. E–5 makes smoke contact with the Green main force and reports to the Commander Southern Scouts and other scouts of the group:

From E–5:

Heavy smoke in sight to southwest. Will investigate.

At 5.30 P. M. E–5 makes out the enemy main force and reports:

From E–5:

Enemy fleet and train lat. twenty-two, long. one thirty-six, four June, five-thirty P. M. Heading eastward. Estimated speed, nine. Destroyers present. Weakly screened.

Am retiring northeast before enemy cruiser.

All force.

Upon receipt of this message the Commander in Chief issues the following campaign order:

From Commander in Chief:

Enemy main body and train, lat. twenty-two, long. one thirty-six, four June, five-thirty P. M. Heading eastward. Estimated speed, nine. Weakly screened. Destroyers present.

Seek decisive engagement.

Contact Scouting Force, Squadrons Three, Five, Division Nine, locate enemy main body on five June, and track.

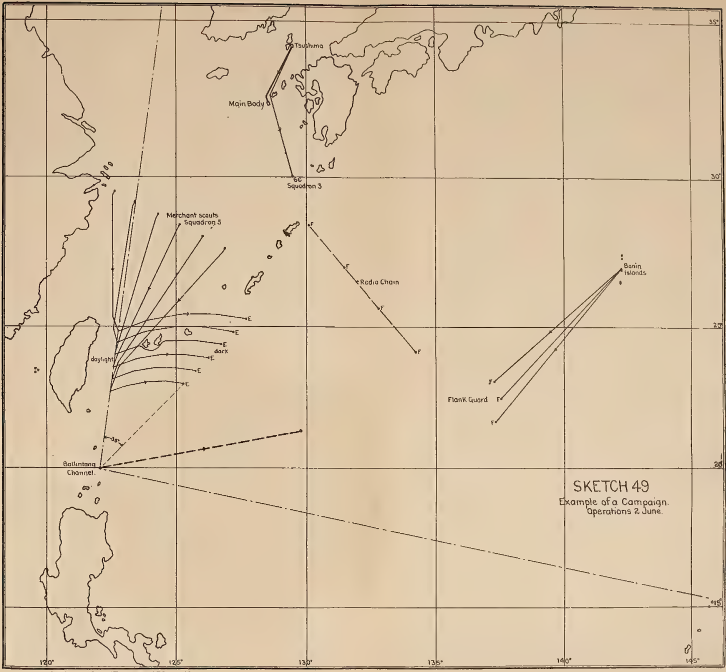
Destroyers proceed to attack enemy main body during darkness.

Main Body steam maximum speed to intercept enemy.

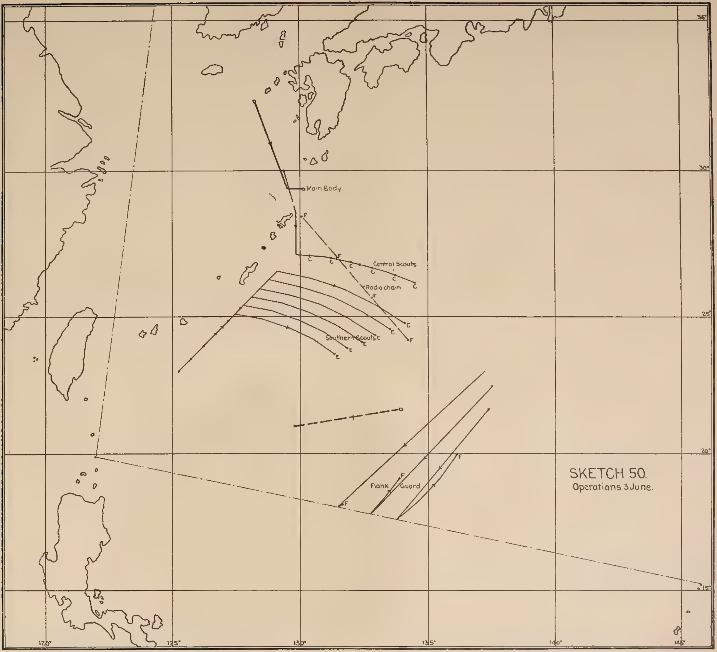
Radio Chain maintain communication.

Campaign order six.

The ships of all scouting detachments should have headed for the reported position of the enemy and each should have reported its position, course, and speed to the detachment commander.



26051—16. (Face p. 272.) No. 1.



26031—16. (Face p. 272.) No. 2.

As soon as the above order is received designating a contact scouting force commander, the commanders of the Southern Scouts and Flank Guard should forward this information to the Contact Scouting Force Commander.

Upon receipt of this information he issues the following campaign order:

From Contact Scouting Force Commander:

Enemy main body and train, lat. twenty-two, long. one thirty-six, four June, five-thirty P. M. Our main body moving to intercept enemy. Destroyers proceeding to attack.

Locate and track enemy main body.

Squadron Three cover arc northward and westward of radius bearing eighty. Distance thirty. Scouting course two thirty-five.

Division Nineteen cover arc westward of radius bearing three thirty-nine. Distance sixty. Patrol search westward. Assume enemy speed twelve.

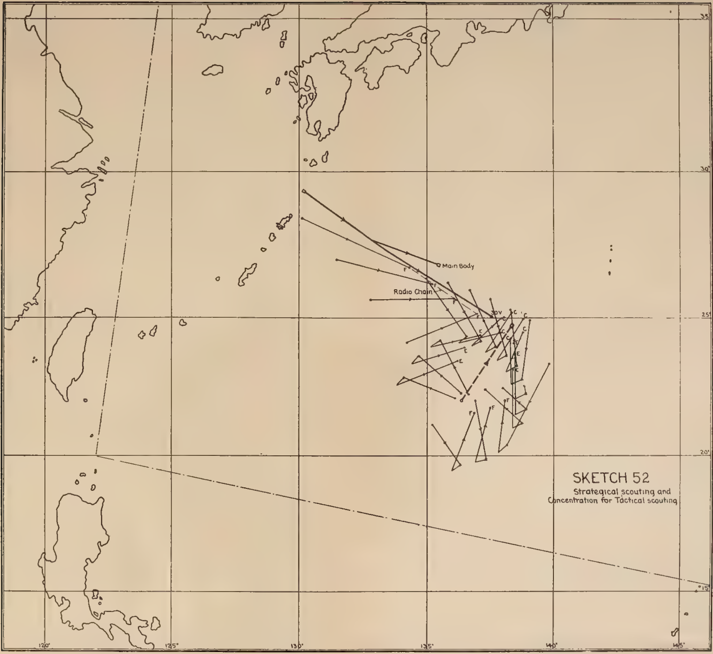
Division Nine cover arc westward of radius bearing one thirty. Distance sixty. Patrol search westward. Assume enemy speed twelve.

Form an arc, radius one fifty, center enemy's reported position. Commence scouting five June, five A. M. Speed maximum. Campaign order one.

The enemy is sighted on 5 June at 5.45 A. M. and the contact scouting force concentrates for tactical scouting without further orders, as shown in Sketch 52.

26051—16——18

26051—16. (Face p. 274.) No. 1.



26051—16. (Face p. 274.) No. 2.

CHAPTER XXVI.

DESCRIPTION OF CAMPAIGN INDICATING USE OF SEARCH FROM AHEAD.

CHAPTER XXVI.

DESCRIPTION OF CAMPAIGN INDICATING USE OF SEARCH FROM AHEAD.

SCOUTING PROBLEM.

SEARCH FROM AHEAD.

Motives.—Estimating the situation. Order writing. Conduct of operations against Blue communications. Methods of search using hydroaeroplanes.

General situation.—In November, 1915, the Blue fleet and permanent train with a convoy of 20 transports occupied TAWI TAWI as a base. During December the Blue fleet operated to secure control of the CALIMIAN GROUP, SAN BERNARDINO STRAITS, and SURIGAO STRAITS.

During this campaign the losses have been heavy on both sides, Blue having lost all the armored cruisers, numerous first-class cruisers, second-class cruisers, and destroyers, and some major ships. Orange lost numerous armored cruisers, first-class cruisers, second-class cruisers, and torpedo craft and all six battle cruisers.

The Blue fleet is now based on the CALIMIAN GROUP.

The Orange fleet is based on the PESCADORES.

CORREGIDOR and POLILLO are occupied by Orange, the land defenses being strongly held.

Blue holds the CALIMIAN GROUP, TAWI TAWI, SAN BERNARDINO STRAIT, SURIGAO STRAIT, and GUAM.

Blue's main line of communication is via GUAM.

Blue's main line of communication is via Guam.

Special situation.—On 31 December, 1915, the Orange commander in chief learns that a large Blue convoy of colliers, supply and ammunition ships escorted by first-class cruisers was sighted on 29 December, 1915, 400 miles east of GUAM. They were headed for GUAM at a speed about 12 knots.

The Orange commander in chief issues the following order:

Orange Fleet,
AA-1, Flagship.

Campaign Order
No. —.

Pescadores,
31 December, 1915, 10 A. M.

Forces.

(a) Main Force.
Fleet, less Raiding Force.

(b) Raiding Force; Rear Admiral O.
Divisions Eleven, Fifteen, plus F-3.
Squadron Nine.

1. Blue fleet and train based on CALIMIAN GROUP. TAWI TAWI, SAN BERNARDINO STRAIT, and SURIGAO STRAIT held by Blue troops. Blue's main line of communications via GUAM. Large convoy escorted by protected cruisers sighted four hundred miles east of GUAM on twenty-nine December, course West, speed twelve.

Orange troops hold LUZON north of Latitude fourteen.

2. This force will operate against Blue's communications while awaiting favorable opportunity to reduce Blue's superiority.

3. (a) Main Force base on PESCADORES. Observe enemy with a view to operating to reduce his superiority.

(b) Raiding Force operate against enemy communications between GUAM and PHILIPPINE bases.

4. Train remain at base. Four five-thousand tons, twelve-knot colliers accompany Raiding Force.

5. AA-1 at PESCADORES.

By direction.
/s/ O. K.
Rear Admiral, Chief of Staff.

Copies to:
Navy Department,
Rear Admiral OJ,
Rear Admiral OQ.

At noon, 31 December, the raiding force and accompanying colliers are ready to sail.

Required.—Estimate of the situation by the raiding force commander, and his order initiating search operations.

Plan of search and reliefs to maintain operations from POLILLO as a base.

Assumptions.—1. Division Eleven, 3 armored cruisers; Division Fifteen, 3 second-class cruisers; Squadron Nine, 8 merchant scouts.

2. Each second-class cruiser and merchant scout carries two hydroplanes.

3. Each hydroplane can make two flights daily; each flight not exceeding $2\frac{1}{2}$ hours in the air will be without probability of breakdown.

4. Fifteen minutes required to put over or hoist in an aeroplane.

5. Ship must be dead in the water for this operation.

6. Navigation by hydroplanes is sufficiently accurate for distance of 75 miles and return. If hydroplane is more than 75 miles from ship, there will be $\frac{1}{6}$ chance of failure to return for each 10 miles in excess.

7. Speed of hydroplanes 75 miles per hour.

8. Range of visibility from hydroplane; single smoke 20 miles, heavy smoke 45 miles.

9. Radio range of second-class cruiser or merchant scout is 250 during daylight, 500 at night. Armored cruisers, 300 during daylight, 600 at night.

10. No radio on hydroplanes.

11. Daylight 6 A. M. to 6 P. M.

SCOUTING PROBLEM NO. 4.

SOLUTION.

General mission.—To operate against Blue communications between GUAM and Blue PHILIPPINE base.

CONSIDERATION OF IMMEDIATE MISSION.

Our task is offensive-defensive. That is, we must organize our forces for the tactical offensive, though the movements of our forces are based upon information of the enemy's intentions—in fact, to oppose his strategical offensive—and are therefore defensive in their strategical character.

The enemy's main force is based on the CALIMIAN GROUP. The future actions of this force or any detachment of it will interfere with our operations only if he sends a reinforcement to assist the first-class cruisers now performing escort duty, or if he should blockade POLILLO with a force sufficiently strong to prevent our free egress and ingress from that base.

The loss of all his armored cruisers, numerous first-class and second-class cruisers, in the previous campaign will greatly handicap him in blockade operations or operations in support of the present convoy escort. The use of major ships or destroyers for this purpose would subject such force to the danger of being cut off and defeat in detail. This danger will prevent Blue reinforcements from proceeding far to the eastward of the PHILIPPINES.

It is improbable that the Blue main force would be divided for the blockade of POLILLO at the present stage of the campaign.

Our own main body will observe Blue with a view to taking the tactical offensive if favorable opportunity to reduce Blue's superiority should offer.

It seems probable that the raiding force will not be opposed by other forces than the present convoy escort until the convoy reaches the vicinity of the PHILIPPINE coast.

Blue forces control SAN BERNARDINO and SURIGAO STRAITS and hold TAWI TAWI.

Blue's main line of communication is via GUAM. From GUAM three routes are available to Blue—via SAN BERNARDINO or SURIGAO STRAITS or to the southward of MINDANAO.

Blue may be sending supply ships from GUAM to the PHILIPPINES, singly or in detachments.

The only knowledge of Blue supply ship or collier movements that we have is as follows: "On 31 December a large convoy of Blue colliers, supply and ammunition ships, escorted by first-class cruisers, was sighted on 29 December, 400 miles east of GUAM, heading west, speed about 12."

As this information is all we have upon which to base our plan, our *immediate mission* becomes:

Immediate mission.—To locate and destroy the Blue convoy, reported 400 miles east of GUAM on 29 December, before it can reach or be reenforced from the Blue PHILIPPINE bases.

Enemy forces.—Their strength, disposition, and probable intentions:

A large Blue convoy, escorted by first-class cruisers, was sighted 400 miles east of GUAM on 29 December. They were heading for GUAM. Speed, about 12 knots.

They could arrive at GUAM on the afternoon of 30 December, if sighted near daylight. If sighted later, they would arrive off GUAM at night, and probably would not enter port and be prepared to coal before daylight 31 December.

This convoy probably coaled last at PEARL HARBOR and has since steamed about 3,300 miles. The first-class cruisers will surely need to coal, and it is probable that all ships will coal from accompanying colliers in order to release them for another trip. If they proceed to a PHILIPPINE base without coaling they will have to take coal there. This would be very inefficient, as they would be taking from a long haul rather than a short haul.

Coaling at GUAM would release the supply colliers, assure their safety, and reduce the size of the convoy to be conducted through the dangerous area.

It may be that the necessity of immediate supply to Blue will counterbalance this advantage, but, even at its best, it would seem that the convoy would not sail from GUAM before 31 December, 6 P. M., even if the ships of the convoy were to proceed singly when ready.

The Blue convoy is escorted by first-class cruisers. As Blue has lost some of this type and as the original number was but 9, the number with the convoy probably does not exceed 6.

The number of ships in the convoy was not stated, but was said to be large. The number probably exceeds 10.

Six first-class cruisers would find it difficult to defend 10 or more supply ships from an equal number of enemy ships, even merchant scouts, at night. They could not form a distant screen effective against armored cruisers. If proceeding concentrated they would attempt evasion. The escort might operate offensively against our scouting force, hoping to destroy it or disperse it, thus facilitating the evasion of the supply ships.

The routes to Blue's PHILIPPINE base are, via:

1. North end of LUZON.
2. SAN BERNARDINO STRAIT.
3. SURIGAO STRAIT.
4. South end of MINDANAO.

Route 1 may be omitted from consideration as it passes too close to our main base at the PESCADORES.

Route 2 is open to the objection of passing close to POLILLO, which is held by Orange, and also to the difficult navigation of SAN BERNARDINO STRAIT.

Routes 3 and 4 are about equal length to TAWI TAWI. Route 3 is shorter to the CALIMIAN GROUP.

If the convoy escort is to be strongly reenforced, SURIGAO STRAIT seems probable, but if the convoy is not to be reenforced a wide detour to southward of MINDANAO seems the most probable.

If the convoy escort is to be reenforced, Blue will have to use battleships to give it much additional strength.

Such reenforcements stand a chance of being cut off if of small force, and if a larger force it would have to be kept within supporting distance of the main body.

It is therefore probable that if the convoy escort is reenforced such reenforcement will not take place more than 300 or 400 miles east of the PHILIPPINES.

The enemy's course of action may be any one of the following:

1. To proceed with the convoy in concentrated formation, using first-class cruisers as a protective or defensive screen.

2. To proceed with the convoy in small groups, using escort as an offensive screen or as advance scouts to aid the convoy by information of the position of the scouting line to pass it undetected.

3. To have the convoy proceed singly, using the escort of first-class cruisers as in course 2.

Course (1) is advantageous if no organized operation by the enemy is anticipated, for the area occupied by the convoy would be as small

as possible, thus subjecting it to the least chance of observation by passing shipping or chance contact with forces employed on other duty.

Its disadvantage consists in the increase in visibility and the difficulty of dispersion or defense of the convoy if discovered.

Course (2). The second course has the disadvantage of covering a much larger area, with only a slight decrease in the range of visibility of the groups, subjecting the convoy to greater chance of detection by passing shipping or ships engaged in other operations. The first-class cruisers are hardly fast enough to be efficient as an offensive screen, for they could not overtake our merchant scouts unless sighted very early in the day. These first-class cruisers might, however, locate our scouting line and direct the movements of the convoy so as to pass unobserved. Acting in groups, the convoy would have a radius of visibility so great that they would have difficulty in avoiding our scouts.

The advantage of this method is that in case dispersion become necessary such dispersion would be started over a larger area.

Course (3) has the general disadvantages of course (2), except that the range of visibility is reduced to a minimum. In this case it seems probable that the convoy would proceed independently by several routes, the ships on each route separated by 30 or 40 miles.

The advantages of this course are of the same nature but greater than in course (2). The dispersion is wider, and not more than one ship of the convoy should be sighted at once.

If the first-class cruisers locate our scouts they may be able to assist the convoy by giving them information which will permit their unobserved passage.

The enemy probably does not know of our plan to operate against his communications, but will anticipate such a movement. It is doubtful if he would separate the ships of the convoy until such operation was assured, unless the delay in waiting for coaling and repairs to the entire convoy would be too great.

The logical course for Blue would seem to be to start with the convoy concentrated, with several first-class cruisers as an escort, the other first-class cruisers as advanced scouts to locate our scouting line, if we have any; this conclusion may be modified by haste to get the stores to base.

Under any circumstances, the first-class cruisers for protective scouting would be advanced by at least 12 hours, and it does not seem probable that they could leave GUAM before 31 December, 6 P. M. We may safely assume the departure of the first ships of the convoy as not earlier than 31 December, 6 P. M.

Our own forces.—Srength, disposition, and courses of action open to us: Our force consists of 3 armored cruisers, 4 second-class cruisers, and 8 merchant scouts, accompanied by 5 colliers.

The armored cruisers are stronger than the entire Blue escort and individually superior, except possibly one ship, which may only be equal to Blue's strongest.

Speeds and radii of action.

	Speed.	12 knots.	15 knots.	18 knots.
Armored cruisers	20	4,175	3,500	2,600
Second-class cruisers	20	3,800	3,300	2,400
Four merchant scouts	20	8,400	7,400	6,150
Do	20	6,500	5,750	4,950

Our immediate mission has two parts: (1) To locate the enemy convoy; (2) to destroy the enemy convoy.

To locate it, we must search for it. To destroy it, we must bring against it a force superior to its escort.

We might send a merchant scout to GUAM to reconnoiter, to determine whether or not Blue has departed. Early information, if accurate, would be valuable, but we do not know how many ships there were in the train, so any information would be approximate. Such reconnoissance would lead to greater endeavor on the part of Blue to send reinforcements. The disadvantages appear to be greater than the advantages.

Our merchant scouts and second-class cruisers are of value in the first part of the operation without the support of the armored cruisers, but for the second part, the armored cruisers are the most effective force.

Our force naturally divides into two task groups; scouts and supports.

CONSIDERATION OF SCOUTING OPERATIONS.

Our scouting operations may have to be continued over a long period of time. We must therefore make provisions for reliefs for coaling and repairs.

METHOD OF SEARCH.

The uncertainty in the time of departure of the Blue convoy and the lack of an observation force off GUAM practically restricts us to the use of the search from ahead.

POSITION OF THE LINE.

Drawing position circles for the Orange scouts and the Blue convoy, assumed time of departure 31 December, 6 P. M., we find the

southern intersection for daylight 3 January in latitude 7° 05′, longitude 134° 20′. This position is about 110 miles to the southward of the direct route to south of MINDANAO.

If we desire to form the line farther to the southward the time will be later. As we can form the line about 150 miles farther south and still cover all probable northerly routes, it is advisable to do so. The line will then be formed at noon, the intersection of the position circles being in latitude 4° 40′ N., longitude 134° 40′ E.

NUMBER OF SHIPS.

From this position it will require nine ships spaced 60 miles apart to cover all routes between this point and the direct course to SAN BERNARDINO. At 90 miles distance but 6 ships would be required.

DISTANCE.

We have on each scouting ship two hydroplanes. Each can make two flights daily. Each flight not to exceed 2½ hours.

These may be used to increase the distance by flight between adjacent ships, the maximum distance for scouting for a large group being about 150 miles; or by using them ahead and astern we may reduce our coal consumption, as the line can be maintained to the front by using a speed as low as 5 knots.

It must not be forgotten that conditions of wind and sea may prevent the use of these planes, and any plan should consider the necessity of searching without them.

There is also another condition which must be remembered. The convoy may separate and proceed singly. Our scouting should contemplate at least a partial search for single vessels.

The most important factor, however, is fuel, and therefore it would seem that the principal use of the planes in this case should be to reduce the fuel consumption.

One other feature adds weight to this conclusion. Our scouts may be driven off by the enemy first-class cruisers, and, if not, our scouts should attack enemy supply ships proceeding singly. It is therefore wise to have as many ships on the line as possible.

The wisest plan seems to be to space the scouts at 60 miles. To use planes ahead and astern to reduce fuel supply and between adjacent vessels to search for single ships.

LINE TO BE MAINTAINED OR ADVANCED.

If we maintain this line to the front, our coal consumption will be less and the distance to POLILLO less than if we advance the line; on the other hand, if we advance the line we cover a wide angle and encounter the convoy farther from the PHILIPPINES. We must strike a mean. The line will be advanced until the southern end is in longitude 137°.

HOW SHALL THE LINE BEAR?

A tangent to the Blue position circle will bring the north end too close to the PHILIPPINES.

In forming a line 173° on southern ship at noon 3 January, the daylight circle for 3 January will be observed by ships proceeding to their stations. This moves the north end away from the PHILIPPINES and is normal to a satisfactory scouting course.

SUPPORTS.

If enemy supply ships are discovered proceeding singly and unguarded they should be attacked by the scouts.

If concentrated and guarded it will probably be necessary to get our armored cruisers into action.

The speed used en route to their best position in rear of the scouting line will require a large expenditure of fuel.

To continue the operation long the armored cruisers will have to be coaled. It seems logical to have one armored cruiser coaling or en route to or from POLILLO at all times. The other two in supporting distance of the scouting line.

Decision.—1. To use Squadron Nine, Division Fifteen, and *F–3* as scouts. To use Division Eleven as support.

2. To form scouting line 173° on southern ship on 3 January, noon, the southern scout to be at a meeting point, assuming Blue convoy time of departure from GUAM 31 December, 6 P. M. Speed 12 knots. Course 227°. Search from ahead. To advance line until southern end is in longitude 137°.

3. To cover all routes between this point and direct course to SAN BERNARDINO STRAIT.

4. To have two armored cruisers on station, one coaling or en route to or from POLILLO.

5. To direct scout commander to arrange reliefs for coaling and repair.

6. To base colliers at POLILLO.

7. To direct all ships to attack unguarded supply ships.

Orange Raiding Force,
B—, Flagship,

CAMPAIGN ORDER
No. 1.

Polillo,
31 December, 1915, 11.30 A. M.

Forces:

(a) *Scouts,* Rear Admiral ON.
Squadron Nine,
Division Fifteen, plus F–3.

(b) *Support.*
Division Eleven.

1. A large enemy convoy escorted by protected cruisers sighted twenty-nine November four hundred miles east of GUAM.

Blue Main Body based on CALAMIAN GROUP.

Blue troops control SAN BERNARDINO, SURIGAO, and TAWI TAWI. Our Main Force will observe Blue with a view to reducing his superiority. Our troops control LUZON north of lat. fourteen.

2. This force will operate against Blue communications between GUAM and PHILIPPINE bases.

3. (a) Scouts. Form line one seventy-three. Southern ship latitude Four forty, longitude One thirty-four forty. Commence scouting three January noon. Cover area to northward to direct route GUAM–SAN BERNARDINO. Search from Ahead. Advance southern end to Long, one thirty-seven. Use planes to reduce fuel consumption and search for single vessels. Relieve for fueling and repairs as required.

(b) Support will maintain two ships rear of scouting line.

(x) Fuel, overhaul POLILLO. Attack unguarded ships.

4. Train proceed POLILLO.

5. Raiding force commander with support.

/s/ OJ, Rear Admiral,
Commanding Raiding Force.

Copies to:
Commander-in-Chief,
Commanders Division
Fifteen, Squadron Nine.
Extract to:
Train Commander.

/s/ ——, Flag Lieutenant.

Sketch 55: The scouts moved to the front at 3 P. M. and soon made contact to the rear. Rain and wind prevented use of planes or advance of scouts until 3 P. M. the next day, consequently scouts retired at the enemy's assumed speed.

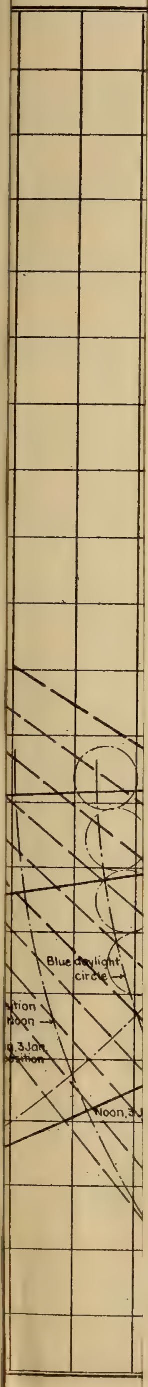
Sketch 55: The scouts moved to the front at 3 P. M. and soon made contact with Blue. At daylight following the disposition of the scouts was as shown in this sketch.

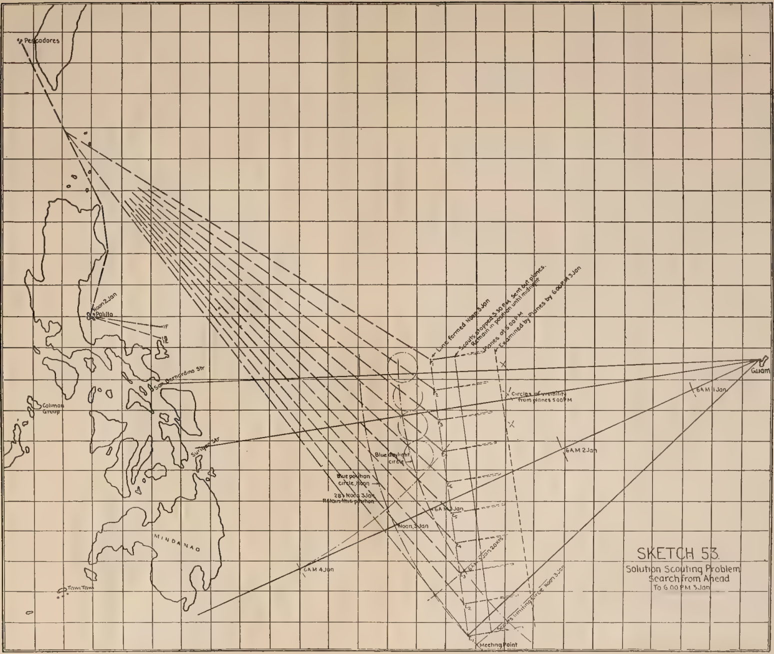
Page 286—notes should read as follows:-

SKETCH 53. The scouts move to the front at noon, 3 Jan., stopped at 3:30 p.m., and lay to until midnight.

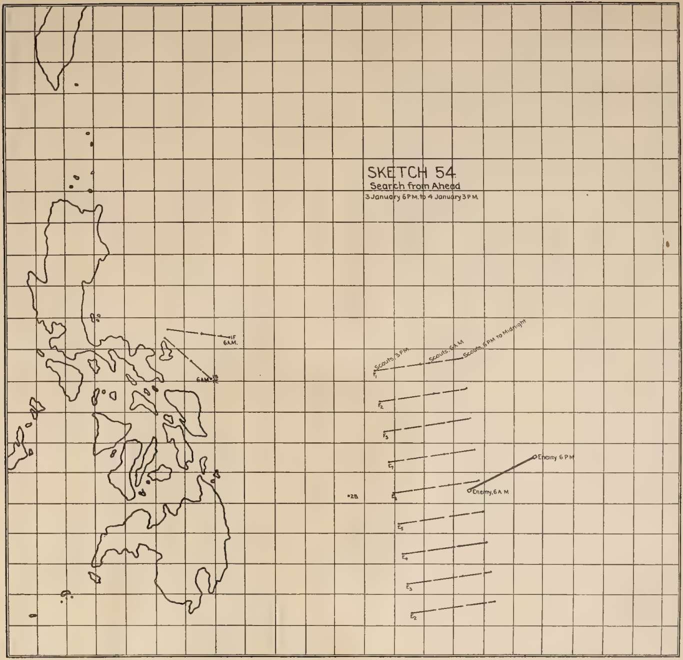
SKETCH 54. 3 Jan., midnight, scouts move to rear. Unfavorable weather at 6 a.m., 4 Jan., caused continuance of movement to rear.

SKETCH 55. Scouts move to front 3 p.m., 4 Jan., and soon made contact with BLUE. At daylight 5 Jan., disposition of scouts was as shown in this sketch.


Blue daylight circle



Pescadores
Noon 2 Jan
Polillo
San Bernardino Str
Surigao Str
MINDANAO
Tawi Tawi
Line formed Noon 3 Jan
Scouts stopped 3.30 PM. Sent out planes.
Remain in position until midnight
Planes at 5.00 PM
Examined by Planes by 6.00 PM 3 Jan
Circles of visibility from planes 5.00 PM
Guam
6 AM 1 Jan
6 AM 2 Jan
Blue daylight circle
Blue position circle, Noon
2B Noon 3 Jan
Retain this position
6 AM 3 Jan
Noon, 3 Jan
6 AM 4 Jan
Meeting Point
SKETCH 53.
Solution Scouting Problem
Search from Ahead
To 6.00 PM 3 Jan



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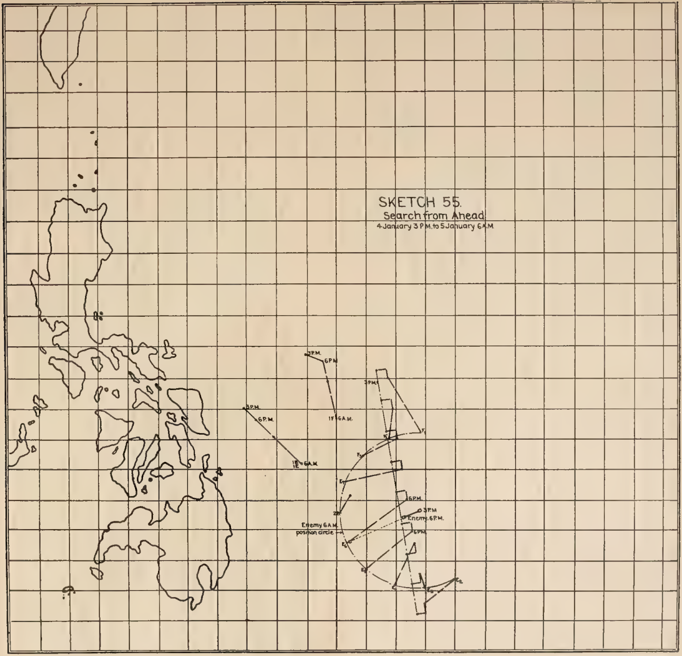

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CHAPTER XXVII.

DESCRIPTION OF CAMPAIGN INDICATING USE OF SECTOR METHOD.

CHAPTER XXVII.

DESCRIPTION OF CAMPAIGN INDICATING USE OF SECTOR METHOD.

This description of a maneuver will indicate the use of the sector method of search, and an example of the use of weak scouts to obtain negative information.

This maneuver will be discussed only from the Orange side. The Orange situation is as follows:

General situation.—War exists between Orange and Blue. On 26 March, Blue occupied AMAMI as an advance base, secured it against raids, and supplied it with a month's stores of coal and provisions. No stores have been received since. On 5 April the Blue fleet established a blockade of NAGASAKI and the entrances to the INLAND SEA. The pressure caused by the blockade was so great that the Orange fleet was ordered from its base in the PESCADORES to break the blockade.

Blue suffered heavily in the blockade operations, and the Blue fleet while attempting to cut off the Orange fleet was attacked at night by the Orange destroyers. An indecisive action between the main bodies was fought the following day off SIMONOSEKI. The approach of night caused the Orange fleet to retire into the INLAND SEA. Blue retired to AMAMI. Both fleets were seriously damaged. The Orange battle cruisers and a number of second-class cruisers took no part in the major engagement, being employed in breaking the blockade of KII and BUNGO CHANNELS.

On 16 April, Orange learned from trusted spies that Blue dispatched on the previous day a force of 4 dreadnaughts, 4 armored cruisers, and 4 protected cruisers to GUAM to escort supply ships to AMAMI; also that Blue's provisions in AMAMI are not sufficient for much in excess of 10 days. Repairs on other Blue ships are in progress.

An Orange squadron of 8 second-class cruisers was immediately ordered to the BONIN ISLANDS to coal, then to proceed toward GUAM to locate and keep touch with Blue escort and train. Four Orange battle cruisers and 15 destroyers at KURE were directed to proceed toward BONIN ISLANDS when ready for sea, and to destroy Blue convoy and escort when they leave GUAM.

On 19 April, 6.30 P. M., a chartered merchant steamer of no fighting value is at COFFIN BAY, one off ANATAXAN ISLAND, and one off GUAM. Their maximum speed is 12, radio range 150–300 miles. Each is in command of an Orange naval officer.

Special situation.—On 20 April, 1 P. M., when the 4 Orange battle cruisers and destroyers are in latitude 32° 30′, longitude 132° 45′, course 125°, speed 18, a radio message is received from the commander of the second-class cruiser squadron, as follows:

From F–4:

Lieutenant S—, in tramp steamer off GUAM, reports Blue escort of four dreadnaughts, four armored cruisers, and four protected cruisers, and train of ten supply ships sailed from GUAM nineteen April, six-thirty P. M. Maximum sustained speed of Blue supply ships is not above eleven.

This force on scouting line two sixty, western ship in lat. twenty-two, long. one forty-one, scouting distance fifty, course one seventy, speed sixteen. Twenty April, eleven A. M.

/s/ OQ.

The decision of the Orange raiding force commander was:

1. To operate on 21 April with the second-class cruisers to eliminate possible easterly routes of Blue convoy by negative information. If Blue screen is encountered, cruisers to retire to northward.

2. To proceed with battle cruisers at maximum sustained speed on direct course for GUAM.

3. To have destroyers proceed at 10 knots toward meeting point with Blue, assuming Blue speed 11 knots, course for AMAMI.

4. To direct tramp steamers to form radio chain between observation force and battle cruisers.

Orange has decided to eliminate by negative information, if possible, the area lying to the eastward of the direct route of the enemy to AMAMI.

He estimated that a course by Blue to the eastward of northeast by east was improbable, also that if a detour was to be made to the northeastward it would probably be made at maximum speed.

The scouting can not be started before daylight 21 April. The position of the scouting line should not at that time be to the southward of Blue's maximum speed, daylight circle.

The eastern ship must be able to search as far south as a line bearing northeast by east from APRA, and in searching must not permit any northerly course to be unexamined. A retiring search curve is the only means available.

The position of the scouts puts a 17-knot vessel on the eastern flank. Her position at daylight 21 April must be such that by dark of that date she can have run a retiring search to a line bearing northeast by east from APRA. The position is latitude 19° 10′ N, longitude 147° 50′ E.

Spacing the ships at distances of 60 miles, the line will cover 420 miles. The western ship will be in latitude 18° 50′ N, longitude 140° 50′ E.

If all these ships search well to the southeastward on this day, all probable areas to eastward of the direct course APRA–AMAMI will be covered. If the enemy's screen is encountered, each scout should endeavor to escape to the northward. An attempt to reconnoiter the screen would probably end in destruction.

If the enemy is not discovered on 21 April, Orange will be fairly certain that Blue has taken a course to the westward of the original position of the western ship of the observation force.

The search on the second day must begin on the radius extended, passing near to the original position of the western scout.

A contact made by the battle cruisers will be more efficient than one made by a second-class cruiser. The battle cruisers should search the area that will be reached by the enemy if he is using his maximum speed.

This line can be reached by the battle cruisers in time to start searching at daylight 22 April.

Some form of the retiring search must be used. Four ships is not a large enough group to cover the proper area. The proper concentration may be maintained and a large area examined by using the sector method. By the use of this method the battle cruisers can make use of their high speed on the outer arc while the second-class cruisers are running the curves of the inner arcs, thus saving their fuel for high speed in effecting a concentration.

From their position at dark, after searching to the southward and eastward, only 2 ships could reach the proper positions to aid the battle cruisers in the sector search.

The sector method, used by the 4 battle cruisers and 2 second-class cruisers, will cover a marked reduction in the enemy's speed or a delay, but not as much as it required to insure success.

The remaining 6 ships of the second-class cruiser squadron should, on the morning of 23 April start a similar search, thus covering the area one day later and covering up most possible avenues of escape.

The danger in the use of the retiring search is that, from any point, the enemy may be steaming toward Amami. A retirement along the radius from GUAM might permit the enemy to pass through the scouting line.

After the scouting line has passed to the westward of the direct course to AMAMI, the course for retirement at night must be toward the enemy's destination.

The Orange destroyers, on account of their very small steaming radius, should not exceed 10 knots until the enemy's force is located.

They must maintain a position nearer to AMAMI than any unsearched area in which the Blue force might lie.

The Orange decision and details of execution have been given. The plan was carried out in the game as follows:

(Sketch 56.)

Move 1—to 5.30 A. M., 21 April.—Here is seen the Orange scouting force formed on Blue's maximum speed daylight circle—the battle cruisers proceeding toward GUAM, and the destroyers proceeding at 10 knots toward their meeting point with Blue. Blue has moved to the southward after leaving GUAM and later turned to about west-northwest.

Move 2—5.30 A. M. to 6.30 P. M., 21 April.—The Orange scouting force moved to the southeastward to clear up that area. The battle cruisers and destroyers are proceeding as before. It looks as though Blue were going to escape. Notice how the scouts will finally gravitate toward the Blue force.

Move 3—6.30 P. M. to 5.30 A. M., 22 April.—This is a dark move. Notice the retirement of the scouting force. The 2 western second-class cruisers are formed on a radius from GUAM in extension of the line formed by the battle cruisers. The destroyers are still moving to the southward at 10 knots. The battle cruisers and 2 second-class cruisers are in position to start a sector search to the westward. The battle cruisers, being on the outer arcs, can take advantage of their high speed. Blue is still moving west-northwest.

(Sketch 57.)

Move 4—5.30 A. M. to noon.—Here we see the first move of the sector method. Notice the speeds and courses of the ships of the group are such as to maintain them at distance 60 miles and on a line of bearing toward GUAM.

The other 6 second-class cruisers are moving west, still covering the area to the east of the direct route to AMAMI. The destroyers have continued. Blue is still moving west-northwest.

Move 5—Noon to 6.30 P. M.—The battle cruisers and 2 second-class cruisers have continued the sector method. Notice how the high speed of the battle cruisers on the outer arc has permitted the rapid swing of this line of scouts.

The other second-class cruisers have continued their search and are now heading for their new daylight position.

The destroyers have continued.

The Blue is still moving west-northwest.

It is now dark and no contact has been made.

Move 6—6.30 P. M. to 5.30 A. M., 23 April—The battle cruisers and 2 second-class cruisers have retired their line in such a direction

that had Blue been just out of sight at dark and at that time headed for AMAMI he could not be to the northward of their line at daylight.

The other second-class cruisers have formed a line on a radius from GUAM to cover all possible delays to the southward. They are in position to start a sector search at daylight.

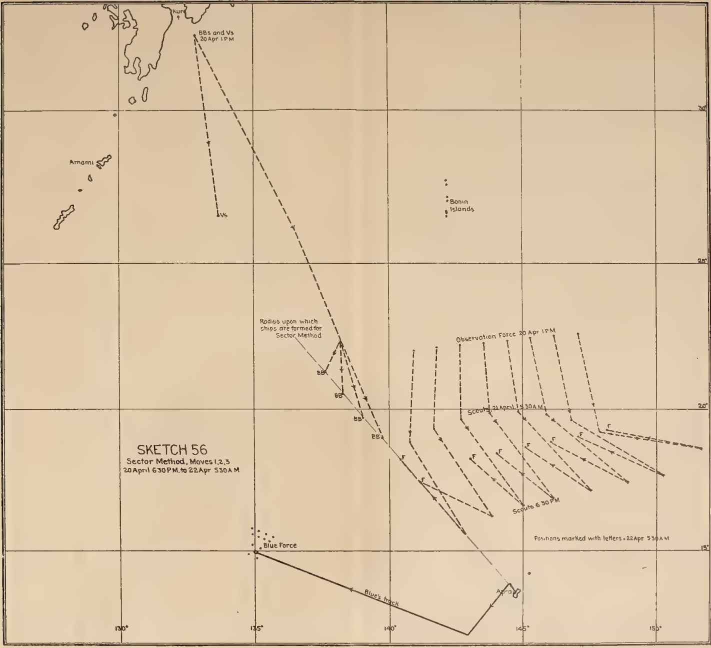
The destroyers have changed course to the westward, knowing that Blue could not have taken a direct route or he would have been discovered.

Blue still continued west-northwest.

(Sketch 58.)

Move 7—5.30 A. M. to 6.30 P. M., 23 April.—The search has been continued and at about 5 P. M. contact is made by the two western battle cruisers and Blue's protective screen driven in.

Move 8—6.30 P. M. to 5.30 A. M., 24 April.—Blue was too strong for Orange to attack that night, but the battle cruisers were formed on a position circle and gained touch at daylight. The following night the Blue force was attacked. Three Blue battleships and all the supply ships were sunk. Orange lost 2 battle cruisers and 10 destroyers.



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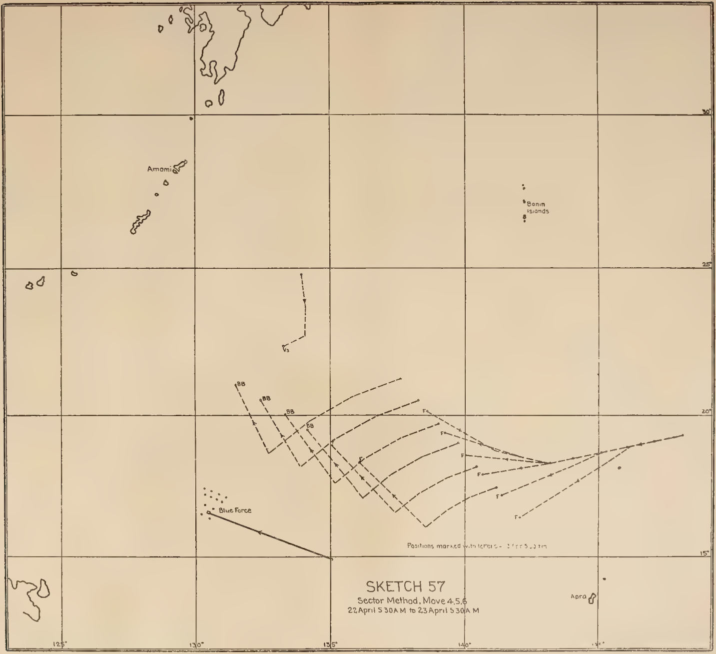
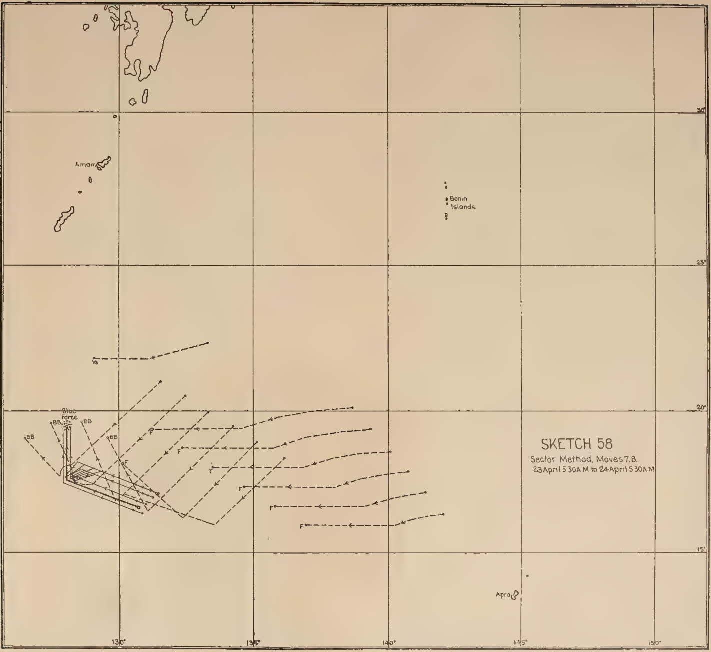


SKETCH 57
Sector Method, Move 4,5,6
22 April 5 30 A M to 23 April 5 30 A M



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CHAPTER XXVIII.

DESCRIPTION OF CAMPAIGN INDICATING USE OF PATROL METHOD.

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DESCRIPTION OF CAMPAIGN INDICATING USE OF PATROL METHOD.

The following description of a maneuver will indicate the use of the patrol method of retiring search, first for search during daylight, and, later, for tactical scouting at night:

General situation.—A Black force of 6 battleships and 10 large transports, carrying 10,000 troops, is temporarily based at CARIACO. The maximum speed of this force does not exceed 13 knots.

A Blue force of 8 battleships (divisions four and five), sustained speed 16 knots, and 6 merchant scouts (squadron nine), sustained speed 20 knots, are coaling at CULEBRA and will be ready for sea by noon, 1 December.

Six Blue submarines and tender are in OLD BAHAMA CHANNEL. Their position report for 1 December, 8 A. M., was: "Latitude twenty-two forty-five, longitude seventy-eight thirty-five, speed twelve, course one-twenty."

Six other Blue submarines and tender are overhauling at KEY WEST and will be ready for sea by 2 December, 6 A. M. Sustained speed of these submarine sections is 10 knots.

CULEBRA is held by the Blue advance base detachment.

The Blue commander has instructions to prevent a raid on COLON, or the occupation of GUANTANAMO or SAMANA.

Black.—The Black force is leaving CARIACO GULF 1 December, at 6 A. M.

At 11 A. M. the Blue commander received the following radio from SAN JUAN:

> Secret service CARIACO reports all enemy battleships and transports sailed from CARIACO one December, six A. M.

The mission selected by the commander of the Blue force was as follows:

1. To deny COLON, GUANTANAMO, and SAMANA to the enemy.

2. To make every endeavor consistent with (1) to locate and decisively engage the enemy force.

The Blue commander decided:

1. To direct the submarines in OLD BAHAMA CHANNEL to proceed at best speed to guard SAMANA.

2. To direct the submarines at KEY WEST to expedite their overhauling and to proceed at best speed to guard GUANTANAMO.

3. To operate with the battleships and scouts to locate and destroy the Black force, if it comes within an area from which it can arrive at SAMANA or GUANTANAMO before the submarines, or if it is proceeding to COLON.

The scout squadron having been directed by signal "To prepare to get underway at noon. Steam for maximum speed," proceeded at that time.

The scout commander, not having had time to definitely decide upon any plan for search, directs maximum speed and sets course for the western intersection of his maximum speed position circle for daylight, with the maximum speed position circle of the enemy for the same time.

At 4 P. M., having decided upon the method of search, the scout commander issued a campaign order, paragraph 3 (x) of which was as follows:

3 (x). Scouts form on enemy position circle two December, six A. M., distance sixty, natural order, search westward, patrol method. E–1 at point of origin lat. fourteen zero two, long. sixty-eight zero seven. Speed twenty. Assume enemy speed thirteen.

Before proceeding with the discussion of the problem, the use of the patrol method, as anticipated in case no contact was made for two days, will be examined. See sketch 59.

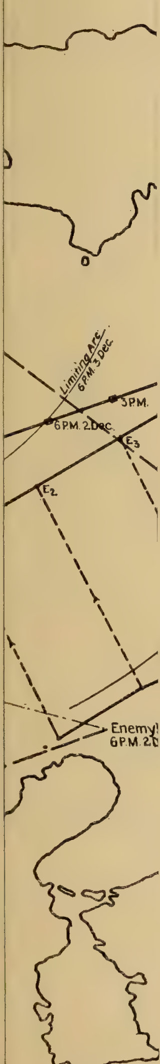
This sketch shows the original disposition of the scouts along the enemy's maximum speed position circle for 2 December, 6 A. M. The eastern scout is placed so far to the eastward that a detour by the enemy to the eastward of this scout would cause a delay great enough to permit the submarines in OLD BAHAMA CHANNEL to arrive at SAMANA before the enemy. This point was found by the use of the limiting ellipse, an arc of which is shown.

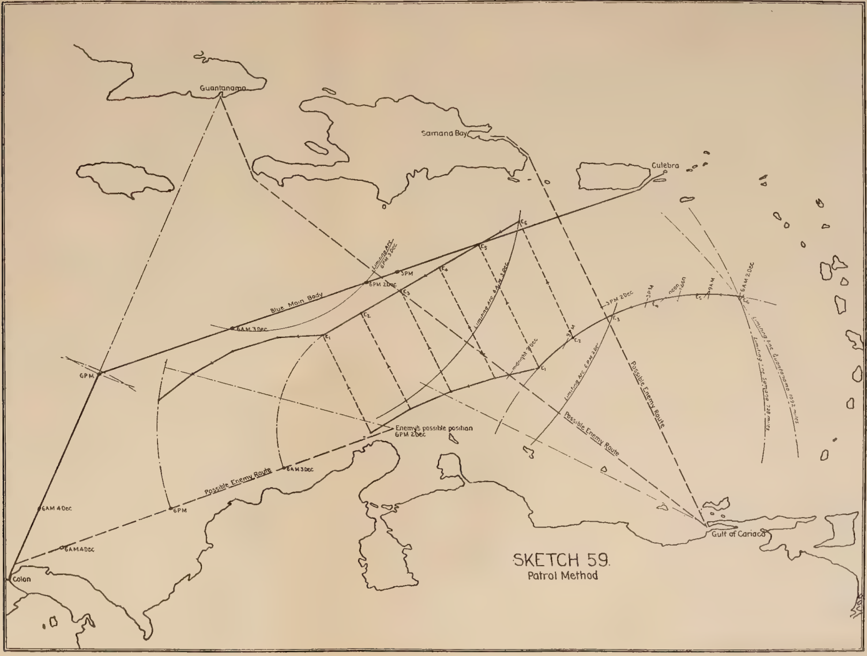
E–1 at daylight starts a retiring search curve to the westward, the other scouts follow the line as formed until they reach the point of origin, when they follow on the search curve.

If no contact has been made by dark the line must be retired so as to guard GUANTANAMO. The search has covered all the area from which the enemy could reach SAMANA before the submarines.

In retiring the line in this method of search, it is customary, in the open sea, for all scouts to retire at the enemy's assumed maximum speed, on the same course as the leader, which is the radius from the point of departure.

In this problem there were several conditions that exerted a determining influence in deciding the course of retirement.


Limiting Arc
6 P.M. 3 Dec.
3 P.M.
6 P.M. 2 Dec.
E3
E2
Enemy


Guantanamo
Samana Bay
Culebra
Blue Main Body
Limiting Arc 6PM 3 Dec
6PM 2 Dec
3PM
6AM 3 Dec
6PM
Limiting Arc 6AM 3 Dec
midnight 2 Dec
3PM 2 Dec
9AM
noon
6AM 2 Dec
Limiting Arc 6PM 2 Dec
Possible Enemy Route
Possible Enemy Route
Limiting line Guantanamo 1092 miles
Limiting line Samana 728 miles
Enemy's possible position 6PM 2 Dec
Possible Enemy Route
6AM 3 Dec
6AM 4 Dec
6PM
6AM 4 Dec
Colon
Gulf of Cariaco
SKETCH 59.
Patrol Method

The principal condition is: All the area from which the enemy could reach GUANTANAMO before the submarines must be searched by such time as it becomes necessary for the Blue main body to proceed to COLON so as to arrive there before the Black force, even if it has steamed for COLON at its maximum speed.

Two considerations govern the position of this line:

1. It must be retired toward GUANTANAMO in such a direction and at such a distance that Black could not have passed the line during darkness.

2. The eastern end of the line must cover any position from which the enemy, having passed astern of the scouts on the previous day, could reach GUANTANAMO before the submarines.

The first condition is fulfilled by drawing arcs of circles with Black's night run as a radius and centers at the places on or near the scouting line which Black could have occupied at dark unobserved.

The second condition is not so easy to fulfill.

The point must lie on a circle, center off CAPE IROIS, and whose radius is equal to the distance the Black force could steam between 3 December, 6 A. M., and the time the submarines arrive at GUANTANAMO minus the distance from this center to GUANTANAMO. This circle is drawn in the sketch and marked limiting arc for 3 December, 6 A. M. If Black is not on or within this circle at daylight 3 December, he can not arrive at GUANTANAMO before the submarines.

$$r \times \frac{S}{s} = 30 \times \frac{20}{13} = \frac{600}{13} = 46 \text{ miles.}$$

The enemy may have crossed the line on which the scouts were steaming on December 2, 46 miles in rear of the last scout, without having been observed.

The most northerly point that Black could have reached on the Black limiting arc for 3 December, 6 A. M., is the point we desire to find. This can be done only by trial and error. Suppose the enemy crossed the line at noon 46 miles in rear of the position of E–~~8~~6 at noon. He could steam 18×13=234 miles by December 3, 6 A. M. With the point 46 miles in rear of the noon position of E–~~8~~6 as a center and a radius of 234 miles, cut an arc intersecting the mentioned limiting circle. This is a possible point for Black at 3 December, 6 A. M.

Do the same for 2 P. M. and 4 P. M. This will indicate the most northerly point. One scout must be at this point, so the line of scouts must be disposed on such a bearing from this point that no part of the scouting line shall be nearer to a possible enemy position for 2 December, 6 P. M., than a night's run of Black, or 156 miles.

Ordinarily the position of the scout most distant from the enemy's point of departure must be on an enemy position circle for the time, but in this case the line has been drawn back to the northeastward and the area in which the line is formed has been searched for the enemy's maximum speed.

As the line upon which the scouts are formed will be held, it is only necessary to make sure that the enemy at his maximum speed could not have passed around the western end of the line. This can be done by assuming his position as the most westerly position that he could have occupied unobserved on 2 December, 6 P. M., as his actual position, and running a retiring search curve on that assumption. This position is marked "A" and the curve is shown in the sketch.

By 3 December, 4 P. M., if the enemy has not been encountered, the Blue commander is assured that Black can not reach GUANTANAMO ahead of the submarines, and he is free to proceed to COLON, with the Blue main body, where he can arrive ahead of Black.

The plan of Blue has been given; the maneuver as played will now be discussed.

Move 1.—Sketch 60 indicates the formation of the Blue scouts on the enemy daylight curve and the movements of all forces during 2 December.

The Blue battleships sailed from CULEBRA 1 December at noon, and, after clearing POINT TUNA, set course 248° and speed 15 knots. This movement was necessary in order that the Blue battleships might be in a position to reach COLON ahead of Black.

The Blue scouts are formed on Black's maximum speed daylight circle. The eastern scout is so far to the east that Black could not pass outside of it and arrive at either SAMANA or GUANTANAMO ahead of the submarines. This position was obtained by use of the limiting ellipse.

The scouting distance is 60 miles. This distance could have been increased to 76 miles and still have been efficient, but with 60 miles enough area can be covered and the greater concentration of the scouting force, for strategical scouting, obtained by a 60-mile distance, is a great advantage. Efficiency of the search takes precedence over concentration, but as much concentration as is consistent with efficiency in the search should be maintained.

Black.—The Black force has not been steaming at its maximum speed, as shown by its position well inside the daylight circle.

The 6 battleships of the escort are in a defensive screen formation, i. e., they are close to the convoy with the idea of protecting the convoy against a night attack.

Move 2—6 A. M. to 8 P. M., 2 December.—Blue: The Blue main body has continued its movement toward COLON.

The Blue scouts at 6 A. M. started the patrol to the westward.

In this method the scout at the point of origin starts a retiring search curve.

E–1, the scout at the point of origin, has taken a course which will bring him to a meeting point 3 hours later, assuming Black's speed as his maximum, 13 knots. The other scouts are steaming toward the point of origin around the line as formed. All scouts are making 20 knots.

At 8 A. M., *E–5* sighted a heavy smoke bearing southwest.

Black: The Black movement to the northward was continued.

The defensive screen formation was maintained in order to cover as little area as possible, hoping thus to avoid discovery.

Move 3—8 A. M. to 9 A. M., 2 December.—Blue: *E–5*, having sighted a heavy smoke to the southwest, immediately headed for it, and at 8.15 A. M. discovered the Black transports closely screened by battleships heading north by west, speed about 12 knots.

The commander of *E–5* sent this radio:

From *E–5:*

Enemy convoy and escort, in position lat. fifteen fifteen, long. sixty-five fifteen, eight-fifteen A. M., course north by west, estimated speed twelve. Will track.

This message was not received by the other scouts or Blue main body until 9 A. M. Their movements until 9 A. M. were, therefore, in accordance with the original plan.

E–5 took up a position for tracking on the starboard bow of the Black force.

Black: The Black force continued its movement. No attempt was made to drive off the scout, as such an operation would require several ships when the scout is of superior speed, and so early in the day it is inadvisable to permit any great dispersion of the escort.

Move 4—9 A. M. to 11 A. M., 2 December.—Blue: At 9 A. M. the Blue commander received the radio message from *E–5* giving the positions of the convoy and escort at 8.15 A. M. As the distance between the Blue main body and Black convoy was about 300 miles, he decided that it would be impossible to bring Black to action during daylight, and therefore headed toward SAMANA, the apparent destination of Black.

Upon receipt of the radio from *E–5* the scout commander headed *E–1* north and sent the following order to the scouts:

From *E–1:*

Enemy convoy and escort in lat. fifteen fifteen, long. sixty-five fifteen, eight-fifteen A. M., course north by west, estimated speed twelve. *E–5* will track.

Scouts, less *E–1* and *E–2*, gain and maintain touch. *E–1* and *E–2* course north, speed twelve.

Upon receipt of the information of the position of the enemy convoy and escort from *E–5*, *E–2*, *E–3*, and *E–4* had headed for the enemy's reported position. This procedure is correct. This course should be maintained until instructions have been received from the scout commander or later information gives another position to head for.

E–6 failed to carry out the proper move. In this case it made no difference, but a uniform procedure is advisable, and the one indicated is deemed best.

At 9.30 A. M. *E–5* noticed that the Black force had changed course to head for MONA PASSAGE, and so informed the Blue force. This radio was not received by the scouts until 11 A. M.

Black: The Black force changed course at 9 A. M. to head for MONA PASSAGE. The defensive screen formation was maintained.

Move 5—11 A. M. to 3 P. M., 2 December.—Blue: The Blue main body continued toward SAMANA.

At 1 P. M. the Blue commander received a radio from the tender of the SAMANA guard to the effect that a heavy sea and strong current would prevent the arrival of the submarines at SAMANA before 3 December, 1 P. M. This delay made it necessary for Blue to guard SAMANA with the battleships until assured that Black could not arrive at SAMANA before 3 December, 1 P. M.

E–1 and *E–2* proceeded north at reduced speeds.

E–3 and *E–4* changed course upon receipt of the information of Black's change of course and gained touch with the enemy battleships, which had expanded their screen to one of 20 miles radius.

E–5 and *E–6* were in contact with the screen to the eastward.

Black: The Black force proceeded on course for MONA PASSAGE. Several more Blue scouts were sighted. It was apparent that Blue would know the exact position of the convoy at dark if the scouts were not driven off.

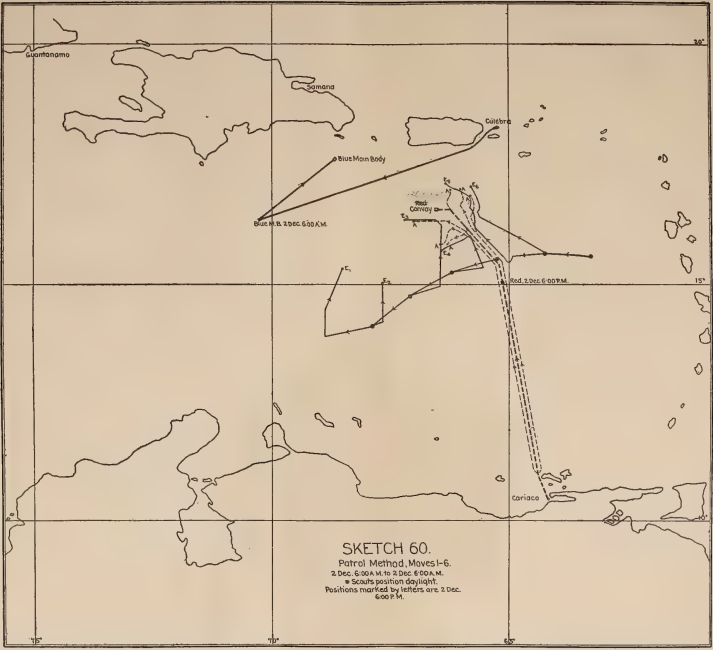
At 2 P. M. the Black battleships started to expand the screen to one of 20 miles radius, in the meantime raising steam for full power. The screen now is a protective screen, as its object is to keep the enemy scouts out of sight of the smoke of the convoy.

Move 6—3 P. M. to 6 P. M., 2 December.—Blue: The Blue main body continued toward SAMANA.

E–1 and *E–2* continued to northward. *E–1* speeded up to 20 knots to get a little nearer the enemy.

Shortly after 3 P. M. the 4 Blue scouts that were in touch with the Black battleships noticed that these ships had changed course and were making for them at high speed.

The result can be seen on the sketch.



26051—16. (Face p. 302.)

By 4.30 P. M. the Blue scouts had all been driven beyond the range of visibility of the smoke of the convoy, and no further contacts were made during that daylight.

Black: Black being a free lance in the hands of the umpire, decided to give up SAMANA and try for GUANTANAMO. In order to reduce the accuracy of Blue's information and to prevent any effort to track at night, the Black screen at 3 P. M. was directed to drive off the Blue scouts. At 4 P. M. the Blue scouts were moving off, and at 4.30 P. M. the course of the convoy was changed to west.

The situation as it appeared to the Blue commander at dark was as follows:

The Black convoy and escort had been tracked from 9 A. M. until 4.30 P. M. They were apparently bound for SAMANA. They were, however, in a position from which they could reach GUANTANAMO before the Blue submarines could arrive there from KEY WEST. They were in a position to arrive at COLON before the Blue battleships, unless the Blue battleships could start for COLON at daylight from a position not to the northward of MONA PASSAGE.

The Black convoy and escort could reach SAMANA before the submarines, so the most pressing need was to guard SAMANA.

The Blue commander decided to move the main body to a position in MONA PASSAGE from which, starting at daylight, it could arrive at any one of the threatened ports before the enemy. To form the scouts on the enemy maximum speed daylight circle, using as a center the reported position of the Black convoy at 4 P. M. This circle covered an area to the northward sufficient to guard against a movement toward SAMANA or GUNTANAMO, but did not cover COLON. He decided therefore to use the patrol search to the southward, starting at daylight and using the position of the southern scout as a point of origin.

The movements from 6 P. M., 2 December, to 6 A. M., 3 December, are shown in Sketch 61.

Move 7—6 P. M., 2 December, to 6 A. M., 3 December.—Blue: The Blue main body proceeded to a position in MONA PASSAGE from which it could arrive at SAMANA previous to the arrival of the Black force, even if Black moved at his maximum speed direct to SAMANA from his 4 P. M. position, and from which, starting at daylight, it could arrive at GUANTANAMO or COLON before the enemy.

The Blue scouts took up their assigned positions on Black's maximum speed daylight circle. *E-2's* navigation was poor, and she is about 10 miles too far west. This move is an example of what is called the "Position circle method of strategical scouting."

The movements from 6 A. M., 3 December, to midnight third-fourth December are shown in Sketch 62.

Move 8—6 A. M. to 10 A. M., 3 December.—Blue: At daylight *E–4* was in sight of a Black battleship and could see the dense smoke of the convoy a few miles beyond. At 6.10 A. M. she sent this radio:

From *E–4:*

Enemy convoy and escort lat. sixteen thirty-five, long. sixty-nine zero five, six A. M. course west, estimated speed thirteen. Will track.

The Blue main body and the other scouts had started at 6 A. M. along the circumference of the circle, except *E–1*, which ship had started the retiring search to the southward.

At 8.45 A. M. they all received the above radio and started a concentration upon the enemy as indicated, *E–1*, *E–2*, *E–3* to southward, *E–4*, *E–5*, *E–6* to northward

Black: The Black convoy, closely screened, maintained its course and maximum speed to the westward.

Move 9—10 A. M. to 3 P. M., 3 December.—Blue: The Blue main body moved at its maximum speed on a course to intercept the Black force.

The Blue scouts, except *E–6*, gained touch with the Black screen, which had been extended to a 20-mile radius.

Black: The Black convoy maintained course and speed. At noon the Black battleships were directed to extend their screen to a 20-mile radius. This extension was made primarily to obtain early information of the approach of the Blue main body, as Black, not knowing the position of the Blue main body, expected an attack at any time after noon.

Move 10—3 P. M. to 6 P. M., 3 December.—Blue: The Blue commander, finding it impossible to bring Black to action during daylight, changed course to the northward to gain a position from which he could arrive at GUANTANAMO or COLON before Black.

The Blue scouts continued tracking the Black force

Black: The Black convoy continued course and speed. No attempt was made to drive the scouts outside of smoke touch, for Black, expecting an engagement at any time, could not afford to disperse his escort.

Move 11—6 P. M. to 12 P. M., 3 December.—Blue: The umpire again asserted his prerogative and, at 6 P. M., Blue received a signal from 4 of his battleships to the effect that they were forced to reduce speed to 14½ knots and could not make any more.

The situation now presented to the Blue commander is quite different from the preceding ones.

At this reduced speed he found that it was impossible to occupy a position after 1 A. M. from which he could reach GUANTANAMO or COLON ahead of the enemy.

SKETCH 61.

Patrol Method, Move 7.

2 Dec 6 00 PM to 3 Dec 6 00 A M
● 6 00 PM positions of scouts
Positions lettered are 6 00 A M

From Black's reported position he could arrive at GUANTANAMO before the submarines.

Blue must decide by 1 A. M. to which port Black is bound.

To allow for the time for radio communication, the scouts must ascertain this information not later than 12.30 A. M. Night scouting must be attempted.

The Blue commander drew two curves, one the maximum speed position circle for midnight (a); the other the limiting circle for Black at midnight to reach GUANTANAMO before the submarines (b).

The lune-shaped area between these curves is the area within which Black must lie at midnight to be in position to reach GUANTANAMO before the submarines. This area must be searched by the scouts.

The visibility at night of the smoke of a large body of ships is assumed as 3 miles; their formation would extend over 1 mile in the direction of their course.

Scouts at rest on this line could only cover 6 miles each, which would be insufficient, as the arc is over 60 miles long.

By the patrol search the scouts can be spaced at a distance of 11 miles (maximum distance formula). By so placing the line that a scout is at one end of the line and running the patrol toward the other end, this method covers the entire distance between intersections on the position circle, and holds the line sufficiently long to assure the Blue commander that Black can not reach GUANTANAMO unobserved, before the arrival of the submarines.

It has the added advantage that in case the entire Black force is bound for COLON no contact will be made, thus using negative information, which, in view of the weakness and size of the Blue scouts, is preferable to an attempt at night tracking.

The scouts were, therefore, at midnight, stationed upon the midnight position circle at distance of 11 miles, and used the patrol search to the southward.

The Blue main body steered a course which would maintain it, up to 1 A. M., in a position from which it could reach either GUANTANAMO or COLON ahead of Black.

Black: Black was directed to try for COLON.

Black changed course for GUANTANAMO at 6 P. M. and closed the screen to defensive position, hoping that if any Blue scouts made contact they would report Black bound for GUANTANAMO.

At 7.30 P. M. Black changed course for COLON, sending 2 battleships on toward GUANTANAMO as a feint.

The Blue scouts encountered these 2 battleships at a few minutes past midnight. The Blue main body was close enough to hear the

firing of the heavy guns and to see the searchlight beams. One Blue scout was sunk.

As no report of the sighting of any enemy transports had been received at 1 A. M., the Blue commander decided that the enemy's move toward GUANTANAMO was a feint, and he therefore changed course for COLON.

Such a decision requires much strength of will and confidence in subordinates. The Blue commander staked the success of his operation on the ability of the scouts to locate the transports if they passed through the area the scouts were searching. In the absence of information of the transports he very properly assumed the transports were not there, and accordingly decided to proceed to COLON.

SKETCH 62
Patrol Method, Moves 8-11.
3 Dec. 6:00 A.M. to 3 Dec. midnight.
• Daylight position of scouts.

CHAPTER XXIX.

PRACTICAL APPLICATION OF METHODS.

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PRACTICAL APPLICATION OF METHODS.

The foregoing methods of search, scouting, and screening are the developments of methods found necessary to cover the various conditions of search, scouting, and screening met in the solution of many such problems at the War College and in the fleet.

It has been the endeavor of the author to devise methods which fulfill all the conditions which have been encountered and which it has been possible for him to conceive.

Many of these methods have proven successful under actual conditions; others have never been tried except in the chart maneuver.

In search or scouting operations the plans are based upon information or assumptions as to the enemy's movements.

The lines to be followed by the scouts should be drawn on the chart and the vessels navigated as closely as possible to these lines.

No amount of theory can demonstrate the practicability of the methods proposed. It is necessary to have theory upon which practice can be based, but much practice is required to demonstrate the practicability of the theoretical methods.

In screening, except offensive screening, the movements of the screen are more or less governed by the movements of the force screened. In this case it may be possible for ships of the main force and screen to steer identical magnetic courses, for all ships in the same vicinity will probably be affected alike by current.

Successful scouting and screening operations require close standardization of speeds and checking of effects of wind and sea in causing leeway.

There is but one way to be sure that these suggested methods are of practical value—trials at sea; and such trials should be conducted as soon as possible in order that such methods as prove impracticable may be eliminated. It must, however, be kept in mind that half-hearted and poorly conducted experiments are the source of much error.